SOIL SURVEY OF

Mellette County, South Dakota

United States Department of Agriculture
Soil Conservation Service
and
United States Department of the Interior
Bureau of Indian Affairs
in cooperation with
South Dakota Agricultural Experiment Station

Issued February 1975

Major fieldwork for this soil survey was done in the period 1957–66. Soil names and descriptions were approved in 1967. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1967. This survey was made cooperatively by the Soil Conservation Service, the Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station. It is part of the technical assistance furnished to the Mellette County Conservation District and the Rosebud Sioux Tribe.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Mellette County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the capability unit and range site in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the descriptions of the capability units, the range sites, and the windbreak groups.

Foresters and others can refer to the section "Windbreaks," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Ranchers and others can find, under "Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Engineers and builders can find, under "Soils and Engineering," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Mellette County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "General Nature of the County."

Cover: Pine Creek, 2 miles west of White River. Buffington silty clay and Haverson silty clay loam are in the valley; Samsil-Lakoma clays, 15 to 40 percent slopes, is in the background.

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SOIL SURVEY OF MELLETTE COUNTY, SOUTH DAKOTA

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, AND UNITED STATES DEPARTMENT OF THE INTERIOR, BUREAU OF INDIAN AFFAIRS, IN COOPERATION WITH THE SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION

MELLETTE COUNTY is in the south-central part of South Dakota (fig. 1). The total land area is 835,840 acres. White River, the county seat and largest town, is located near the center of the county. Wood, Norris, and Mosher are other towns and villages in the county.

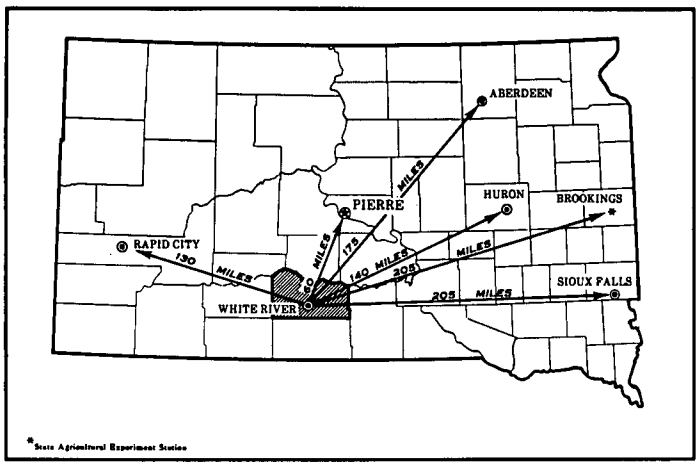

Figure 1.—**Location of Mellette County in South Dakota.**

Mellette County lies in the White River drainage basin. This east-flowing river forms the northern boundary of the county. Relief ranges from nearly level on the flood plains, terraces, and smoother parts of the uplands to steep in rough, broken areas along the White River and its larger tributaries. Badland areas are in the western and southern parts of the county.

Approximately 82 percent of the county is used for range or native hay, 15 percent is used for crops, and the rest is used for miscellaneous purposes. Livestock is the main source of income, and livestock farming and ranching are the main farm enterprises. Most farms and ranches also raise some wheat, sorghum, oats, and alfalfa. Wheat is the principal cash crop and is a major source of income for some farms in the southeastern and southwestern parts of the county.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Mellette County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The soil series and the soil phase are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important charactistics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Mosher and Cedar Butte, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects manage-

[1] T. KARNS was party leader for Bureau of Indian Affairs personnel who surveyed most of the area in Tps. 40 and 41 N., Rs. 25, 26, 27, and 28 W.; T. 42 N., Rs. 25 and 26 W.; and east of the Little White River, Tps. 40 and 41 N., R. 29 W.

ment. For example, Huggins silt loam, 2 to 5 percent slopes, is one of several phases within the Huggins series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Three such kinds of mapping units are shown on the soil map of Mellette County: soil complexes, soil associations, and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intermingled or so small in size they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Huggins-Kadoka silt loams, 0 to 2 percent slopes, is an example.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Imlay-Badland association is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Bankard and Glenberg soils is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Badland is a land type in Mellette County.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others; then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Mellette County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

A comparison of the general soil map of this county with those in published surveys of adjoining counties will show small areas where soil boundaries that overlap county lines do not match perfectly and soil names differ. Such differences in the maps have resulted from continuing refinement of soil classification, changes in classification by soil series, and the establishment of new series that do not appear in earlier published surveys.

The 11 soil associations in Mellette County have been placed in six general kinds of landscapes for purpose of making broad interpretations. Each of the broad groups of soil associations and the associations in each group are described on the following pages.

Moderately Well Drained and Well Drained Silty and Loamy Soils That Formed in Alluvium; in Stream Valleys

Soils in this group formed in loamy to sandy alluvium. They are used for growing feed crops and hay and for grazing and winter feeding. They are subject to stream overflow in some years, but damage is generally minor.

1. Haverson-Glenberg association

Deep, nearly level to gently sloping, moderately well drained and well drained silty and loamy soils

This association is on bottom land along the White and Little White Rivers. It is nearly level except for rises from one level to another. The lower flood plains are commonly slightly undulating.

This association makes up about 4 percent of the county. It is 35 percent Haverson soils, 25 percent Glenberg soils, and 40 percent less extensive soils.

Haverson soils have a surface layer of light brownish-gray silty clay loam. Below this is silt loam commonly stratified with silty clay, silty clay loam, and fine sand.

Glenberg soils have a surface layer of light brownish-gray fine sandy loam. Below this is pale-brown and light-gray very fine sandy loam.

Less extensive in this association are Bankard soils on the lower flood plains, Buffington and Mitchell soils on high bottoms or low terraces, and Kyle soils on foot slopes and fans on the outer edges of stream valleys.

In some years stream overflow floods the lower areas of this association, but the effects generally are limited to damaged fences and thin deposits of sediment and debris. Fertility is low. Soil blowing is a hazard. Controlling soil blowing and conserving moisture are concerns in management.

Many areas along the White River are cultivated. Corn, sorghum, and alfalfa are the main crops. Small grain also is grown. A few areas are irrigated. Others are in native grass and are used for hay or grazing. A number of ranch headquarters are located on this association. Scattered stands of native trees and shrubs provide protection in winter for livestock and wildlife.

Moderately Well Drained to Excessively Drained Clayey Soils Over Shale; on Uplands

Soils in this group formed in clayey material derived from shale of Cretaceous age. They have slow to very slow permeability. Surface runoff ranges from slow to rapid, depending on the slope. The gently sloping, deeper soils are used for crops and range. The strongly sloping to steep, mostly shallow soils are used entirely for grazing.

2. Samsil-Lakoma association

Shallow and moderately deep, strongly sloping to steep, well-drained to excessively drained clayey soils

This association is along the White and Little White Rivers and their principal tributaries. The landscape is one of moderately steep or hilly to steep valley sides laced with many short drainageways that flow into long, narrow, deeply dissected, V-shaped draws and canyons. Drainageways and channels are commonly gullied. Steep cut banks and slides are common in areas adjacent to the White River.

This association makes up 22 percent of the county. It is about 65 percent Samsil soils, 15 percent Lakoma soils, and 20 percent less extensive soils.

Samsil soils have a thin surface layer of light brownish-gray clay. Below this is clay and shaly clay. Bedded shale is at a depth of 17 inches.

Lakoma soils have a surface layer and subsoil of grayish-brown clay. At a depth of 18 inches is shaly clay. At a depth of 24 inches is bedded shale.

Less extensive in this association are Anselmo and Manter soils in small areas blanketed with sandy deposits; Buffington soils along creeks and drainageways; Kyle soils on foot slopes and fans; Murdo and Schamber soils on gravelly ridges and terrace fronts; Opal soils on narrow, flattened ridges; and Promise soils on foot slopes and along drainageways. Outcrops of shale occur in the steeper parts of the association.

Surface runoff is rapid. Permeability is slow. Available water capacity of the major soils is low to very low. Steep slopes make this association highly erodible and limit its use mainly to grazing.

3. Promise-Millboro association

Deep, nearly level to gently sloping, well-drained clayey soils

This association is in the southeast corner of the county. It is nearly level to gently sloping. Slopes are long and smooth. Most of the drainageways are shallowly entrenched, but the drainage pattern is well defined.

This association makes up about 5 percent of the county. It is about 50 percent Promise soils, 15 percent Millboro soils, and 35 percent less extensive soils.

Promise soils are clay to a depth of more than 40 inches. Their surface layer is dark gray, and the subsoil is dark gray and grayish brown. In most places the entire profile is calcareous.

Millboro soils have a surface layer of dark-gray silty clay and a thick subsoil of grayish-brown clay. They are calcareous below a depth of 13 inches. The underlying material is clay.

Less extensive in this association are Lakoma and Samsil soils on shoulders of drainageways, Kolls and Hoven soils in closed depressions, Opal soils on the upper part of some of the rises, and Reliance soils on well-rounded ridges and knolls above Millboro soils.

Surface runoff is moderate, and permeability is slow to very slow. Available water capacity is low to medium. Tilth deteriorates easily in cultivated areas. Controlling water erosion and soil blowing, conserving moisture, and maintaining tilth are management needs in cultivated areas.

Many of the gently sloping and nearly level areas are cultivated. Winter wheat, sorghum, and alfalfa are the main crops. Some corn and some spring-sown small grain also are grown. Sloping areas are mostly in native grass and are used for grazing.

4. Opal-Promise-Samsil association

Shallow to deep, nearly level to strongly sloping, moderately well drained and well drained clayey soils

Most of this association is gently sloping to strongly sloping. Slopes are dominantly long and uniform. Slopes along drainageways, however, are short, and some are moderately steep to steep. A striking feature of the land surface on parts of the association that are in native grass is the wavy effect caused by small ridges that rise a few

inches above troughs. The small ridges and troughs extend up and down the slope. Except in a few closed depressions, the drainage pattern is well defined.

This association makes up about 19 percent of the county. It is 40 percent Opal soils (fig. 2), 15 percent Promise soils, 15 percent Samsil soils, and 30 percent less extensive soils.

Opal soils are gently sloping to strongly sloping and are well drained. They have a surface layer of dark-gray silty clay and gray clay, a clay subsoil, and clay underlying material. At a depth of 34 inches is bedded shale.

Promise soils are deeper over shale than Opal soils. They are nearly level to gently sloping. They are well drained except along drainageways, where they are moderately well drained. The surface layer is dark-gray clay, and the subsoil is dark-gray and grayish-brown clay. The underlying material is clay to a depth of more than 40 inches.

The steep, shallow Samsil soils are along drainageways and on the tops and sides of ridges. The surface layer is light brownish-gray clay. The next layers are clay and shaly clay that extend to a depth of 17 inches. Below this is bedded shale.

Less extensive in this association are Buffington soils on low terraces along creeks and drainageways; Caputa, Manter, and Tuthill soils in scattered areas that are thinly mantled with loamy to sandy material; Hoven and Kolls soils in depressions; Lakoma soils in areas of Samsil soils; Minatare and Mosher soils in swales and along drainageways; Murdo and Schamber soils on gravelly ridges; and Woodly soils in swales. Slickspots occur along some of the drainageways.

Surface runoff is moderate to rapid, and permeability is slow to very slow. Available water capacity ranges from medium in Promise soils to very low in Samsil soils. Tilth deteriorates easily in cultivated areas. Controlling water erosion and soil blowing, conserving moisture, and maintaining or improving tilth are all management needs in cultivated areas.

Some of the nearly level and gently sloping parts of this association are cultivated, particularly those in the eastern part of the county. Winter wheat, alfalfa, and sorghum are the main crops. Corn and spring-sown small grain also are grown. Many areas are in native grass and are used for grazing.

Well-Drained Loamy Soils That Formed in Loamy to Sandy Material; on Uplands

Soils in the one association in this group formed in sandy material deposited or reworked by wind. The nearly level and gently sloping soils have a high enough organic-matter content and enough silt and clay in the subsoil to make them stable. They are used for crops and range. The undulating to hilly soils are less stable and blow easily when the vegetation is disturbed.

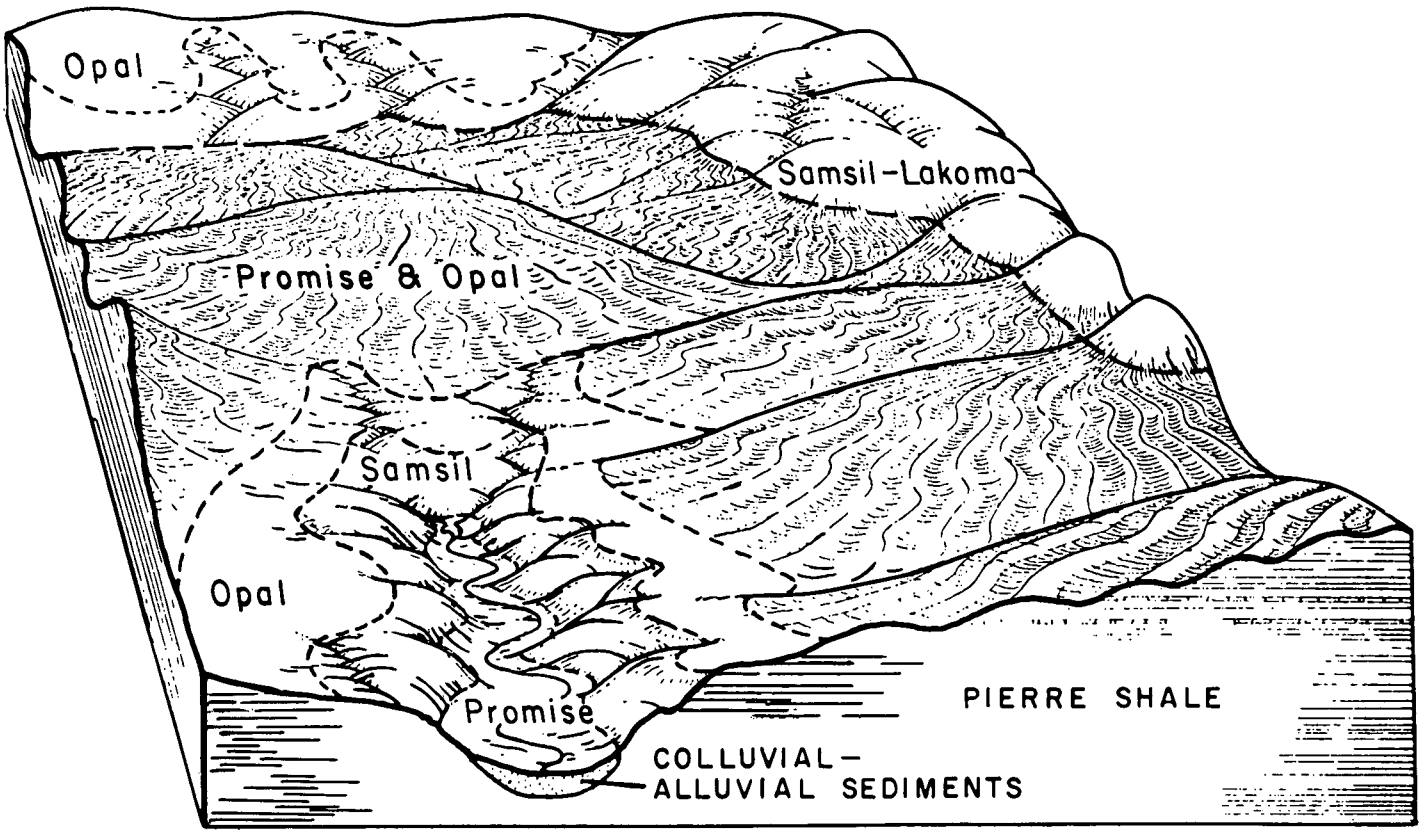

Figure 2.—Typical pattern of soils and underlying material in the Opal-Promise-Samsil association.

5. *Tuthill-Manter association*

Deep, nearly level to sloping or undulating, well-drained loamy soils

This association occurs as small, scattered, isolated areas in the southern part of the county. It is mostly gently sloping to sloping. The sandier parts are undulating.

This association makes up about 6 percent of the county. It is about 35 percent Tuthill soils, 10 percent Manter soils, and 55 percent other soils.

Tuthill soils have a surface layer of grayish-brown fine sandy loam and a subsoil of fine sandy loam and sandy clay loam. The underlying material is pale-brown loamy sand.

Manter soils are commonly undulating. They have a surface layer of dark-gray fine sandy loam and a subsoil of fine sandy loam and sandy loam. The underlying material is loamy sand.

Less extensive in this association are the undulating to hilly Anselmo, Dunday, and Valentine soils; Huggins and Kadoka soils in lower positions on the landscape, in the southwestern part of the county; Opal and Promise soils on the lower slopes, below Tuthill soils, in the central part of the county; Whitelake soils on foot slopes and along some of the drainageways; and Woodly soils in swales.

These soils are medium in fertility and take in water readily. Surface runoff is slow to moderate. Soil blowing is a hazard and is the main concern in management. Water erosion is an additional concern in sloping areas.

This association is used mainly as range. Some of the nearly level to gently sloping parts are cultivated. Winter wheat, corn, sorghum, and alfalfa are the chief crops. Soil blowing is difficult to control in areas where winter wheat is grown.

Well-Drained to Excessively Drained Loamy, Silty, and Clayey Soils Over Siltstone, Mudstone, and Shale; on Uplands

Soils in this group formed in material weathered from siltstone, mudstone, and shale of Tertiary age. In places the landscape is broken by eroding escarpments and gullied drainageways. Many of the soils have low to very low available water capacity as well as other properties unfavorable for crops. They are used mainly as range. Scattered tracts of cropland are mainly in areas of gently sloping soils.

6. *Imlay-Conata-Badland association*

Shallow, gently sloping to steep, well-drained to excessively drained loamy and clayey soils and areas of Badland

This association is gently sloping to steep. The relief is broken by numerous escarpments and eroding drainageways. In these areas slopes are short, steep, and barren of vegetation. Drainage channels commonly are vertically walled and actively eroding.

This association makes up about 19 percent of the county. It is about 27 percent Imlay soils (fig. 3), about 13 percent Conata soils, 10 percent Badland, and 50 percent less extensive soils.

Imlay soils are mostly strongly sloping to steep. The surface layer is light brownish-gray clay loam. The underlying material is gravelly clay loam. Bedded siltstone is at a depth of 10 inches.

Conata soils also are mostly strongly sloping to steep. Their surface layer is brown and reddish-gray clay. The subsoil is multicolored clay. Mudstone is at a depth of 17 inches.

Badland consists of eroding exposures of mudstone, shale, and siltstone. Within the Badland areas are small, nearly level to gently sloping mesas or tables that are isolated from each other by eroding escarpments or sides of drainageways. The eroded areas are barren of vegetation.

A number of less extensive soils occur throughout this association, including scattered areas of Anselmo, Dunday, and Valentine soils in stringers of sandy material; the gently sloping Blackpipe soils on foot slopes below Imlay and Conata soils; Buffington soils on low terraces or bottoms along creeks and drainageways; Cedar Butte, Hisle, Wanblee, and Wortman soils on flats, foot slopes, and along drainageways; Haverson and Stirk soils on bottom land; Larvie, Metre, Norrest, and Okreek soils on small mesas or tables within areas of Badland; and Orella soils on flats and rounded knolls.

Surface runoff ranges from moderate to rapid in much of the association. The major soils are low in fertility and are very low in available water capacity. Controlling erosion is a concern in the Badland parts of the association.

Much of the Badland is barren of vegetation. Many areas cannot be crossed by farm machinery. Most vegetated areas, however, are accessible to livestock. The association is used almost entirely as range. A few tracts of the less extensive soils are cultivated. Sorghum, oats, and alfalfa are the main crops.

7. *Norrest association*

Moderately deep, nearly level to strongly sloping, well-drained silty soils

This association is dominantly nearly level to strongly sloping, but it is moderately steep to steep on the sides of ridges and along deeply entrenched drainageways. The drainage pattern is well defined.

This association makes up about 8 percent of the county. It is about 55 percent Norrest soils. The other 45 percent is less extensive soils.

Norrest soils have a surface layer of grayish-brown silt loam and a subsoil of silty clay loam and clay loam. Soft siltstone is at a depth of 32 inches.

Less extensive soils in this association are Blackpipe soils on foot slopes and in swales; Cedar Butte, Hisle, Wanblee, and Wortman soils on upland flats and foot slopes and along drainageways; Conata and Imlay soils on ridges and some of the steeper slopes; Larvie, Metre, and Okreek soils in areas underlain by shale or mudstone; and small areas of Badland around heads of drainageways.

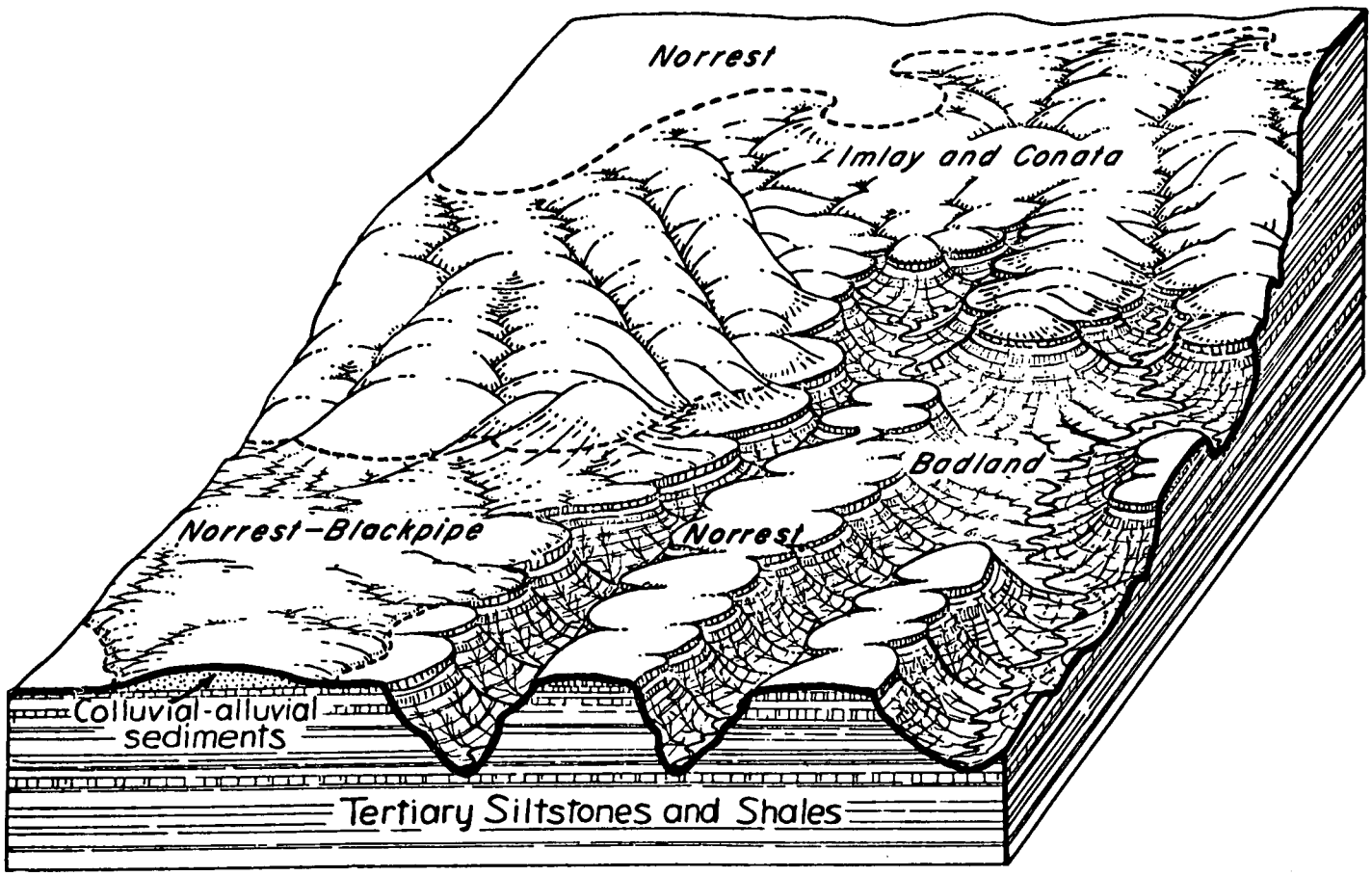

Figure 3.—Typical pattern of soils and underlying material in the Imlay-Conata-Badland association.

Norrest soils are medium to low in fertility and have low to medium available water capacity. Surface runoff is moderate in most areas. Controlling erosion is the main concern in management.

This association is used mainly as range, but small, scattered tracts are used for crops. Winter wheat, sorghum, and alfalfa are the main crops.

Well-Drained to Excessively Drained Silty and Loamy Soils Over Siltstone; on Uplands

Soils in this group formed in material weathered from siltstone of Tertiary age. Most of the strongly sloping to steep soils are shallow, and the gently sloping soils are moderately deep. In most areas these soils are used as range. Some of the less sloping areas are used for crops.

8. Epping-Huggins-Imlay association

Shallow to moderately deep, sloping to steep, well-drained to excessively drained silty and loamy soils

This association consists of ridges and steep slopes along drainageways that flow to the Little White River. It is along the southern boundary of the county.

This association makes up about 3 percent of the county. It is about 40 percent Epping soils, 25 percent Huggins soils, 15 percent Imlay soils, and 20 percent less extensive soils.

The steep Epping soils, on the tops and sides of ridges, are well drained to excessively drained. They are gray and pinkish-gray silt loams that are shallow over pinkish-gray siltstone.

The well-drained Huggins soils are commonly less steep than Epping soils. They have a surface layer of gray silt loam and a subsoil of silty clay loam. The next layer is silty clay loam. Bedded siltstone is at a depth of 22 inches.

Imlay soils are strongly sloping to steep and well drained to excessively drained. They are on some of the sides of ridges near Epping soils. They have a surface layer of light brownish-gray clay loam. Below this is gravelly clay loam. Bedded siltstone is at a depth of 10 inches.

Less extensive in this association are Kadoka soils in areas of Huggins soils, Keota soils intermingled with Epping soils along drainageways, and Larvie and Metre soils below Imlay soils.

Most of this association is too steep for cultivation. Surface runoff is moderate to rapid, and erosion is a hazard. Available water capacity of the major soils is low. Almost all of this association is in native grass and is used as range.

9. *Huggins-Kadoka association*

Moderately deep, nearly level to strongly sloping, well-drained silty soils

This association is mostly gently sloping to sloping. Slopes are moderately long. Steeper slopes occur on the sides of some of the ridges and along entrenched drainageways.

This association makes up about 8 percent of the county. It is about 30 percent Huggins soils, 10 percent Kadoka soils, and 60 percent less extensive soils.

Huggins soils are mostly nearly level to sloping. They have a surface layer of gray silt loam and a subsoil of silty clay loam. The next layer is silty clay loam. Bedded siltstone is at a depth of 22 inches.

Kadoka soils are mostly nearly level to gently sloping. They are similar to Huggins soils, but have a less clayey subsoil. Their surface layer is grayish-brown silt loam, and the subsoil is silty clay loam. Below this is pink silt loam. Siltstone is at a depth of 31 inches.

Less extensive in this association are Anselmo, Dunday, Manter, Tuthill, and Whitelake soils in scattered areas thinly mantled with sandy material; Duroc soils in swales and slightly depressed areas; Epping and Keota soils on the sides of entrenched drainageways and on the tops and sides of some of the ridges; Kube soils intermingled with Kadoka soils; and Wanblee and Wortman soils on flats and foot slopes and along drainageways.

The major soils of this association are medium in fertility and have low to medium available water capacity. Surface runoff is moderate. Controlling water erosion and soil blowing and conserving moisture are the main concerns of management in areas of cropland.

This association is used for crops and as range. Winter wheat, alfalfa, and sorghum are the main crops.

Well-Drained Silty and Loamy Soils That Formed in Old Alluvium; on Terraces and Uplands

Soils in this group formed in old alluvium deposited over loamy to gravelly material. They are on high terraces and uplands. Many are nearly level. The deep soils have high available water capacity. Most of the acreage is cultivated.

10. *Savo association*

Deep, nearly level to gently sloping, well-drained silty soils

This association occurs as four small areas near the town of Wood. It is mostly nearly level. Slopes are long and smooth.

This association makes up less than 1 percent of the county. It is about 80 percent Savo soils. The other 20 percent is less extensive soils.

Savo soils have a surface layer of dark-gray silty clay loam. The subsoil is also silty clay loam, but is more clayey than the surface layer. The underlying material is calcareous, light brownish-gray silty clay loam. At a depth of 58 inches is sand and gravel.

Less extensive in this association are Altvan and Murdo soils in areas that are less than 40 inches deep over gravel, Keya soils in swales and slightly depressed areas, Promise soils along some of the drainageways, and Ree soils on some of the rises.

Savo soils are medium in fertility and have medium to high available water capacity. Surface runoff is slow to moderate. Permeability is moderately slow. Conserving moisture and controlling soil blowing are the main concerns in management. Water erosion is a slight hazard in the gently sloping parts of the association.

About 75 percent of this association is cultivated. Winter wheat, sorghum, oats, corn, and alfalfa are the main crops. All but winter wheat are grown mainly for livestock feed.

11. *Ree association*

Deep, nearly level to gently sloping, well-drained loamy soils

This association occurs as scattered areas on high terraces or tables along the White River and its tributaries. Slopes are long and uniform and mostly smooth.

This association makes up about 5 percent of the county. It is about 50 percent Ree soils. The other 50 percent is less extensive soils.

Ree soils have a surface layer of dark grayish-brown loam about 7 inches thick and a subsoil of clay loam. The next layer is calcareous, light brownish-gray loam. At a depth of 40 inches is light yellowish-brown fine sandy loam.

Keya, Lowry, and Savo soils are the most common of the less extensive soils in this association. Keya soils are in swales and in flat, slightly depressed areas. Lowry soils are on terraces closest to the White River. Savo soils are on some of the higher terraces. Other less extensive soils are the sloping Altvan and Murdo soils that are less than 40 inches deep over gravel; Minatare, Mosher, Wanblee, and Wortman soils on flats along drainageways; and the steep Schamber soils along entrenched drainageways.

The Ree soil is easy to work and has moderate permeability. Surface runoff is slow to moderate. Fertility is medium. Available water capacity is high. Conserving moisture is the main concern in management of nearly level areas. Water erosion is an additional concern in gently sloping areas.

About 50 percent of this association is cultivated. Winter wheat, sorghum, oats, corn, and alfalfa are grown. All but winter wheat are grown mainly for livestock feed.

Descriptions of the Soils

This section describes the soil series and mapping units in Mellette County. Each soil series is described in considerable detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping unit in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from

the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second, detailed and in technical terms, is for scientists, engineers, and others who need to make thorough and precise studies of soils. Unless it is otherwise stated, the colors given in the descriptions are those of a dry soil. In the profile descriptions percentages of coarse fragments, such as siltstone and shale fragments and gravel, are measured by volume of the soil material, not by weight.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Badland, for example, does not belong to a soil series, but nevertheless, is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, range site, and windbreak group in which the mapping unit has been placed. The page for the description of each capability unit and range site can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*5*).[2]

Descriptions and names of soils in this survey do not fully agree with those in recently published soil surveys of adjacent counties. Differences result from better knowledge of the soils, modifications in concepts of soil classification, variations in mapping intensities, and differences in extent of the soils in the survey. The characteristics of the soil series described in this county are considered to be within the range defined for that series. In those instances where a soil series has one or more features outside the defined range, the differences are explained.

Altvan Series

The Altvan series consists of well-drained, sloping loamy soils that are moderately deep over sand and gravel. These soils formed in alluvium on high terraces and uplands.

In a representative profile the surface layer is dark grayish-brown loam about 7 inches thick. The subsoil, about 21 inches thick, is dark grayish-brown clay loam in the upper part, grayish-brown clay loam in the middle part, and calcareous, light-gray gravelly clay loam in the lower part. It is very hard when dry and firm to very firm when moist. Below the subsoil is grayish-brown and light olive-brown sand and gravel.

Altvan soils are medium in organic-matter content and fertility. Permeability is moderate in the surface layer and subsoil and rapid in the underlying sand and gravel. Surface runoff is moderate. Available water capacity is low to medium.

[2] Italic numbers in parentheses refer to Literature Cited, p. 110.

Most areas are in native grass and are used for grazing. Sorghum and small grain are the main crops in the few areas that are cultivated.

Representative profile of Altvan loam, 5 to 9 percent slopes, 750 feet east and 600 feet north of the southwest corner of sec. 26, T. 43 N., R. 27 W.:

A11—0 to 3 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak, fine, platy structure parting to weak, fine, granular and subangular blocky; soft, friable; neutral; abrupt, smooth boundary.

A12—3 to 7 inches, dark grayish-brown (10YR 4/2) heavy loam, very dark grayish brown (10YR 3/2) moist; weak, medium, prismatic structure parting to weak, fine and medium, subangular blocky and granular; hard, friable; small pockets of fine gravel; neutral; clear, smooth boundary.

B21t—7 to 12 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) crushing to dark brown (10YR 3/3) moist; moderate, medium and fine, prismatic structure parting to moderate, medium and fine, subangular blocky; very hard, firm, slightly sticky; many fine open pores; thin, continuous clay films; neutral; clear, smooth boundary.

B22t—12 to 21 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate, medium and fine, prismatic structure parting to moderate, fine, blocky; very hard, very firm, slightly sticky; few organic stains of very dark grayish brown on faces of peds; many very fine partly closed pores; thin, continuous clay films; mildly alkaline; gradual, smooth boundary.

B3ca—21 to 28 inches, light-gray (2.5Y 7/2) gravelly clay loam, grayish brown (2.5Y 5/2) moist; few faint mottles of dark grayish brown; weak, medium and coarse, prismatic structure parting to weak, medium, blocky; very hard, very firm, slightly plastic; thin patchy clay films on faces of peds; 5 to 10 percent fine and medium gravel; many fine to coarse segregations of lime; violent effervescence; moderately alkaline; gradual, smooth boundary.

IIC—28 to 60 inches, grayish-brown (2.5Y 5/2) and light olive-brown (2.5Y 5/3) sand and gravel; single grained; loose; undersides of gravel in upper part coated with lime; moderately alkaline.

Depth to sand and gravel ranges from 20 to 40 inches. Small pebbles are common throughout the A and B horizons. The A horizon ranges from dark grayish brown to brown in hue of 10YR. It is commonly loam, but ranges from sandy loam to silt loam. It ranges from 2 to 9 inches in thickness.

Altvan soils are near Murdo, Ree, Schamber, and Tuthill soils. They are deeper over sand and gravel than Murdo and Schamber soils. At a depth of less than 40 inches they have a more gravelly C horizon than Ree and Tuthill soils.

Altvan loam, 5 to 9 percent slopes (AlC).—This soil is on high terraces and remnants of terraces on uplands. It has the profile described as representative of the series.

Included with this soil in mapping are areas of Keya, Murdo, and Ree soils. Keya soils are along drainageways in some areas, Murdo soils are in areas where the depth to gravel is less than 20 inches, and Ree soils are in areas where the depth to gravel is greater than 40 inches.

This Altvan soil is droughty. Surface runoff is moderate. Controlling erosion and conserving moisture are the main concerns in cultivated areas.

This soil is better suited to early maturing small grain and sorghum than to corn. Most areas are in native grass and are used for grazing. Silty range site; capability unit IVe–5; windbreak group 6.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Altvan loam, 5 to 9 percent slopes	4,670	0.6	Mitchell silt loam	4,741	0.6
Badland	7,499	.9	Mosher soils	2,829	.3
Bankard and Glenberg soils	6,977	.8	Murdo gravelly loam, 2 to 9 percent slopes	5,316	.6
Barren badland	4,316	.5	Murdo-Lakoma complex, 6 to 15 percent slopes	5,605	.6
Blackpipe soils	1,295	.2	Murdo-Schamber gravelly loams, 9 to 15 percent slopes	4,797	.6
Buffington silty clay loam	2,826	.3	Norrest silt loam, 5 to 9 percent slopes	6,142	.7
Buffington silty clay loam, channeled	10,344	1.4	Norrest-Badland association	2,585	.3
Buffington silty clay	6,984	.8	Norrest-Blackpipe silt loams, 0 to 2 percent slopes	1,413	.2
Buffington silty clay, channeled	7,781	.9	Norrest-Blackpipe silt loams, 2 to 5 percent slopes	6,943	.8
Buffington clay	1,110	.1	Norrest-Cedar Butte silt loams, 3 to 9 percent slopes	5,760	.7
Buffington soils, channeled	4,180	.5	Norrest-Imlay silt loams, 5 to 9 percent slopes	8,418	1.0
Buffington-Minatare complex	3,206	.4	Norrest-Imlay silt loams, 9 to 15 percent slopes	15,422	2.0
Caputa loam, 2 to 5 percent slopes	4,500	.5	Norrest and Okreek soils, 2 to 5 percent slopes	3,981	.5
Caputa loam, 5 to 9 percent slopes	2,022	.2	Opal clay, 5 to 9 percent slopes	17,578	2.1
Cedar Butte association	2,922	.3	Opal clay, mounded, 5 to 9 percent slopes	8,383	1.0
Conata-Larvie clays, 9 to 25 percent slopes	1,535	.2	Opal-Caputa complex, 2 to 5 percent slopes	4,485	.5
Dunday loamy fine sand, 6 to 9 percent slopes	5,899	.7	Opal-Caputa complex, 5 to 9 percent slopes	4,202	.5
Dunday and Anselmo soils, 0 to 6 percent slopes	7,485	.9	Opal-Mosher complex, 2 to 6 percent slopes	3,859	.5
Dunday and Valentine soils, 9 to 15 percent slopes	3,925	.5	Opal-Promise clays, 2 to 5 percent slopes	16,470	2.0
Duroc and Kadoka silt loams, 0 to 2 percent slopes	1,355	.2	Opal-Tuthill complex, 2 to 5 percent slopes	2,412	.3
Duroc and Kadoka silt loams, 2 to 5 percent slopes	3,130	.4	Opal-Tuthill complex, 5 to 15 percent slopes	3,189	.4
Epping-Huggins silt loams, 5 to 15 percent slopes	2,477	.3	Opal-Woodly complex, 3 to 9 percent slopes	3,708	.4
Epping-Huggins silt loams, 15 to 40 percent slopes	4,196	.5	Orella-Badland complex	1,232	.1
Glenberg fine sandy loam	3,216	.4	Promise clay, 0 to 2 percent slopes	8,901	1.0
Haverson silt loam	3,241	.4	Promise clay, 2 to 5 percent slopes	3,894	.5
Haverson silt loam, channeled	5,190	.6	Promise soils	2,886	.3
Haverson silty clay loam	1,341	.2	Promise and Opal clays, 0 to 2 percent slopes	6,135	.7
Haverson soils	3,299	.4	Promise and Opal clays, 2 to 5 percent slopes	24,883	3.0
Hisle and Orella soils, 0 to 15 percent slopes	6,121	.7	Promise-Mosher complex, 0 to 2 percent slopes	3,033	.3
Huggins silt loam, 2 to 5 percent slopes	2,133	.3	Promise soils and Slickspots	4,277	.5
Huggins silt loam, 5 to 9 percent slopes	2,429	.3	Ree loam, 2 to 5 percent slopes	539	.1
Huggins-Epping silt loams, 5 to 15 percent slopes	13,189	1.6	Ree and Keya loams, 0 to 2 percent slopes	11,784	1.4
Huggins-Kadoka silt loams, 0 to 2 percent slopes	1,034	.1	Ree and Keya loams, 2 to 5 percent slopes	11,439	1.3
Huggins-Kadoka silt loams, 2 to 5 percent slopes	7,545	.9	Samsil clay, 15 to 40 percent slopes	72,136	8.5
Huggins and Wortman silt loams, 2 to 5 percent slopes	1,441	.2	Samsil-Lakoma clays, 9 to 15 percent slopes	13,092	1.6
Imlay-Badland association	13,033	1.6	Samsil-Lakoma clays, 15 to 40 percent slopes	42,110	5.0
Imlay and Conata soils, 6 to 15 percent slopes	11,310	1.4	Samsil-Manter complex, 15 to 40 percent slopes	6,703	.8
Imlay and Conata soils, 15 to 40 percent slopes	37,428	4.5	Samsil-Schamber complex, 15 to 40 percent slopes	27,602	3.3
Imlay-Norrest silt loams, 9 to 25 percent slopes	18,961	2.3	Samsil-Shale outcrop complex	4,539	.5
Kadoka-Kube silt loams	4,327	.5	Sandy land	1,064	.1
Keota-Epping silt loams, 9 to 15 percent slopes	2,555	.3	Savo silty clay loam, 0 to 2 percent slopes	12,762	1.6
Kolls and Hoven soils	2,829	.3	Savo silty clay loam, 2 to 5 percent slopes	6,250	.7
Kyle clay	4,239	.5	Savo silty clay loam, 5 to 9 percent slopes	1,673	.2
Lakoma-Murdo complex, 9 to 15 percent slopes	3,151	.4	Schamber-Murdo gravelly loams, 15 to 25 percent slopes	7,210	.9
Lakoma-Samsil clays, 5 to 15 percent slopes	46,929	5.6	Schamber-Samsil complex, 15 to 40 percent slopes	10,095	1.2
Lakoma-Samsil clays, 15 to 40 percent slopes	8,838	1.0	Stirk clay	1,262	.2
Larvie clay, 5 to 9 percent slopes	2,171	.3	Tuthill fine sandy loam, 3 to 6 percent slopes	5,003	.6
Larvie-Conata clays, 6 to 15 percent slopes	4,318	.5	Tuthill-Opal complex, 2 to 9 percent slopes	3,334	.4
Larvie and Hisle soils, 0 to 9 percent slopes	5,426	.7	Tuthill and Whitelake fine sandy loams, 0 to 5 percent slopes	2,695	.3
Larvie-Metre clays, 2 to 5 percent slopes	4,568	.5	Tuthill-Woodly fine sandy loams, 0 to 3 percent slopes	1,627	.2
Lowry silt loam, 0 to 2 percent slopes	8,309	1.0	Tuthill-Woodly fine sandy loams, 3 to 6 percent slopes	8,346	1.0
Lowry silt loam, 2 to 5 percent slopes	1,953	.2	Valentine fine sand, 15 to 35 percent slopes	3,225	.4
Lowry-Slickspots complex	1,443	.2	Wanblee-Whitelake complex	5,707	.7
Manter-Anselmo fine sandy loams, 9 to 15 percent slopes	2,781	.3	Wanblee-Wortman association, 0 to 5 percent slopes	8,548	1.1
Manter-Samsil complex, 9 to 25 percent slopes	2,480	.3	Woodly fine sandy loam	2,402	.3
Manter-Tuthill fine sandy loams, 6 to 9 percent slopes	7,033	.8	Woodly-Opal complex, 2 to 5 percent slopes	2,930	.4
Millboro-Reliance complex, 2 to 5 percent slopes	4,631	.6	Wortman and Wanblee silt loams	6,614	.8
Millboro-Reliance complex, 5 to 9 percent slopes	3,177	.4	Miscellaneous (gravel pits and depressions)	323	(1)
Minatare soils	3,684	.4	Water (less than 40 acres)	4,950	.6
			Total	835,840	100.0

[1] Less than 0.05 percent.

Anselmo Series

The Anselmo series consists of deep, well-drained, nearly level to rolling loamy soils on uplands. These soils formed in eolian sandy material.

In a representative profile the surface layer is dark grayish-brown fine sandy loam about 9 inches thick. The subsoil, about 17 inches thick, is brown fine sandy loam in the upper part and pale-brown fine sand in the lower part. The upper part is slightly hard when dry and friable when moist. The underlying material is pale-brown fine sand.

Anselmo soils are medium in organic-matter content and fertility. Permeability is moderately rapid, and surface runoff is slow to moderate. Available water capacity is low to medium. Anselmo soils blow easily if the surface is disturbed.

Most areas are in native grass and are used for grazing and hay.

The Anselmo soils in Mellette County are mapped only with Dunday and Manter soils.

Representative profile of Anselmo fine sandy loam in an area of Manter-Anselmo fine sandy loams, 9 to 15 percent slopes, 390 feet west and 375 feet south of the northeast corner of sec. 29, T. 40 N., R. 30 W.:

A11—0 to 4 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) crushing to very dark grayish brown (10YR 3/2) moist; weak, fine, granular and subangular blocky structure; soft, very friable; neutral; abrupt, smooth boundary.

A12—4 to 9 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) crushing to very dark grayish brown (10YR 3/2) moist; weak, medium, prismatic structure parting to weak, medium and fine, subangular blocky and granular; slightly hard, very friable; neutral; clear, smooth boundary.

B2—9 to 16 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak, medium and coarse, prismatic structure; slightly hard, friable; neutral; gradual, smooth boundary.

B3—16 to 26 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; weak, coarse and very coarse, prismatic structure; slightly hard, very friable; faces of prisms coated dark brown (10YR 4/3) moist; neutral; diffuse, smooth boundary.

C1—26 to 35 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; weak prismatic structure parting to single grained; slightly hard, loose; neutral; diffuse, smooth boundary.

C2—35 to 60 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grained; loose; neutral.

The A horizon is commonly fine sandy loam, but ranges from loamy sand to loam. It ranges from 6 to 15 inches in thickness. The B horizon ranges from 6 to 25 inches in thickness. The C horizon ranges from fine sand to fine sandy loam in texture. In some areas the material below a depth of 40 inches is clayey, silty, or gravelly.

Anselmo soils are mapped with Dunday and Manter soils. They are less sandy than Dunday soils. They do not have the distinct increase in clay in the B horizon that is typical of Manter soils.

Badland

Badland (3 to 40 percent slopes) (Ba) is 50 to 75 percent Barren badland, 10 to 20 percent Imlay soils, and 5 to 15 percent Norrest soils. The Barren badland parts are moderately steep to steep escarpments. The rest is less steep and is covered with vegetation. These vegetated areas are small and are closely intermingled with Barren badland on the less steep parts of the escarpments on foot slopes and on low-lying mesas.

Included in the areas mapped are tracts of Blackpipe, Conata, Epping, and Haverson soils. Blackpipe soils are adjacent to Norrest soils on foot slopes and low-lying mesas, Conata and Epping soils are on the vegetated and less steep parts of the escarpments, and Haverson soils are on narrow bottom land along drainageways.

Surface runoff is medium to rapid, and geologic erosion is active and severe. Many areas cannot be traversed by vehicles, but most areas that support vegetation are accessible to livestock and can be grazed. Barren badland in capability unit VIIIs–2, not assigned to a range site or windbreak group; Imlay soil in capability unit VIIs–1, Shallow range site, windbreak group 10; Norrest soil in capability unit VIe–3, Clayey range site, windbreak group 10.

Bankard Series

The Bankard series consists of deep, well-drained, nearly level, calcareous sandy soils on bottom land. These soils formed in stratified sandy alluvium.

In a representative profile the surface layer is light brownish-gray loamy very fine sand about 4 inches thick. Below this is 10 inches of white loamy very fine sand and very fine sand. Next is a 2-inch layer of light brownish-gray sandy loam. At a depth of 16 inches and extending to a depth of 60 inches is white very fine sand.

Bankard soils are low in organic-matter content and fertility. Permeability is rapid, and surface runoff is slow or very slow. Most areas are subject to periodic flooding. Available water capacity is low.

Most areas are in native grass and are used for grazing or hay. Scattered trees, mostly cottonwood, are in areas near stream channels.

Representative profile of Bankard loamy very fine sand in an area of Bankard and Glenberg soils, 2,375 feet north and 1,320 feet west of the center of sec. 34, T. 45 N., R. 32 W.:

A1—0 to 4 inches, light brownish-gray (2.5Y 6/2) loamy very fine sand, grayish brown (2.5Y 5/2) moist; weak, fine, granular and platy structure; soft, very friable; strong effervescence; moderately alkaline; clear, smooth boundary.

C1—4 to 14 inches, white (2.5Y 8/2) loamy very fine sand, light brownish gray (2.5Y 6/2) moist; thin platy structure parting to single grained; loose; strong effervescence; moderately alkaline; abrupt, smooth boundary.

C2—14 to 16 inches, light brownish-gray (2.5Y 6/2) sandy loam, grayish brown (2.5Y 5/2) moist; weak, medium and coarse, subangular blocky structure; soft, friable; strong effervescence; strongly alkaline; abrupt, smooth boundary.

C3—16 to 60 inches, white (10YR 8/2) very fine sand, light brownish gray (10YR 6/2) moist; single grained; loose; stratified with thin lenses of finer and coarser material; violent effervescence; strongly alkaline.

The entire profile is commonly calcareous, but in some profiles the A horizon is noncalcareous. The A horizon ranges from dark grayish brown to light brownish gray in hues of 2.5Y or 10YR. It ranges from loamy sand to very fine sandy loam in texture and from 2 to 8 inches in thickness. The C horizon is dominantly loamy sand and sand that in places contain thin lenses of silty and gravelly material. The sand is mostly fine or very fine.

Bankard soils are mapped with Glenberg soils and are similar to Valentine soils. They are more sandy than Glenberg soils. In contrast with Valentine soils, they are calcareous and their underlying material is more stratified.

Bankard and Glenberg soils (0 to 3 percent slopes) (Bg).—Some areas of this mapping unit are mostly Bankard soil, some are mostly Glenberg soil, and some contain both soils in proportions that differ from one area to another. These soils are on bottom land and low terraces mainly along the White and Little White Rivers. The Bankard soil is typically on the lower flood plains nearest the river channel. In some areas both soils are closely intermingled; the Bankard soil occupies the low-lying ridges and the Glenberg soil the low areas between the ridges. The profile of the Bankard soil is the one described as representative of the series. The Glenberg soil is described under the heading "Glenberg Series." In areas recently flooded, the surface layer of these soils ranges from fine sand to clay.

Included with these soils in mapping are small areas of Buffington and Haverson soils.

Bankard and Glenberg soils are low in organic-matter content and fertility. Surface runoff is slow to very slow. Flooding is a hazard. Bankard soils are droughty, and both soils are subject to blowing in cultivated areas.

Most of the acreage is in native grass and is used for grazing or hay. Cottonwood trees along the streams provide protection in winter for livestock and game animals. Bankard soil in Sands range site, capability unit VIe–8, windbreak group 10; Glenberg soil in Overflow range site, capability unit IIIe–7, windbreak group 2.

Barren Badland

Barren badland (15 to 40 percent slopes) (Bk) consists mainly of moderately steep to steep escarpments of eroding exposures of siltstone, mudstone, or soft shale. These eroding exposures of bedrock material make up 75 percent or more of the mapped areas (fig. 4). Many gullied drainageways lace the areas.

Included in the areas mapped are small parcels of Conata, Haverson, Imlay, and Norrest soils. Haverson soils are below the escarpments on narrow bottom land along drainageways. The rest are on the low-lying mesas and the vegetated, less sloping parts of the escarpments. Inclusions of soils that support vegetation make up as much as 25 percent of some areas.

Surface runoff is rapid. Severe geologic erosion is the main concern in management. Only the areas of included soils are protected by vegetation, and some of these are inaccessible to livestock. Capability unit VIIIs–2; range site and windbreak group not assigned.

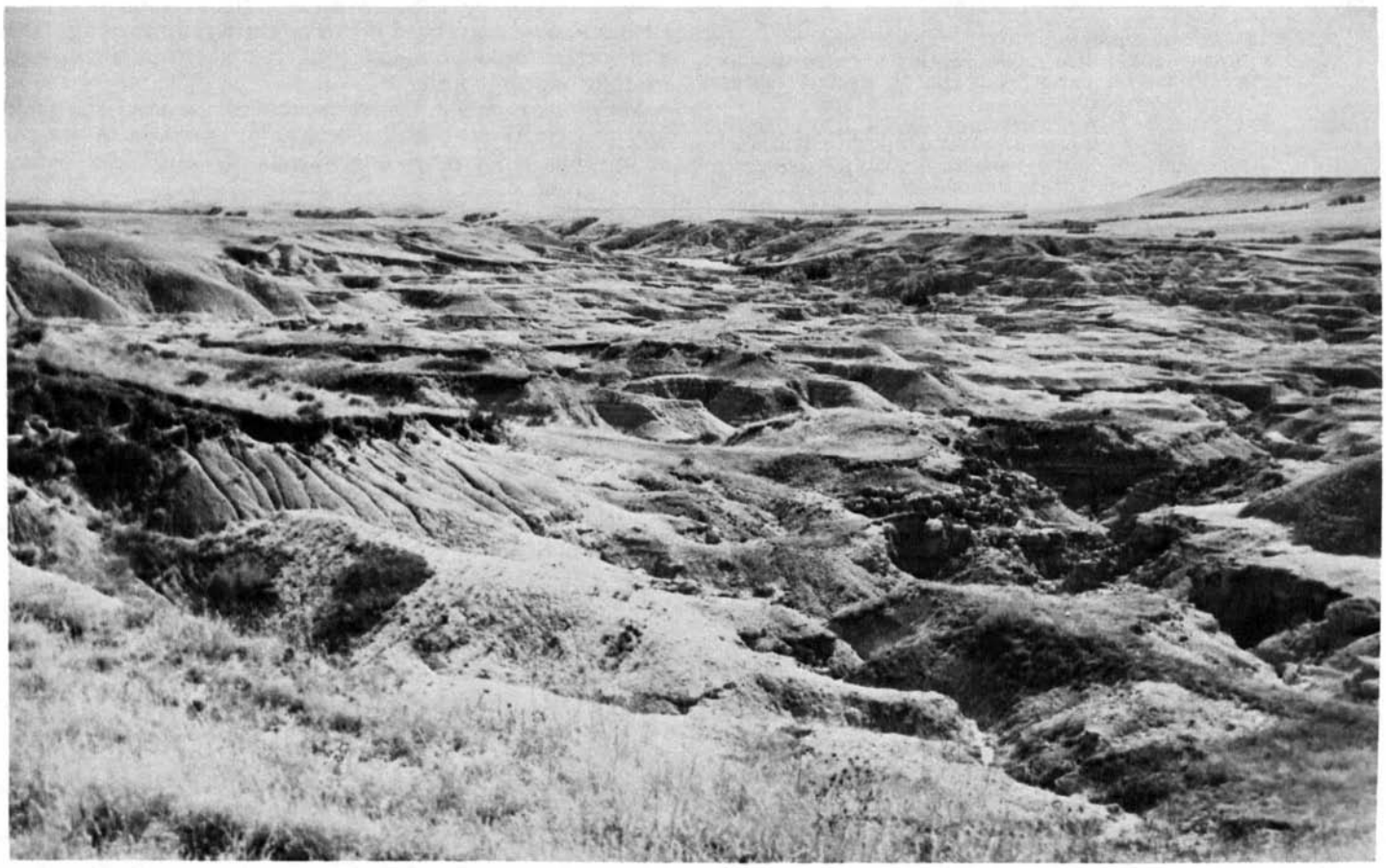

Figure 4.—**Barren badland. Only about 25 percent of the acreage supports vegetation.**

Blackpipe Series

The Blackpipe series consists of moderately deep, moderately well drained, nearly level to gently sloping silty soils on uplands. These soils formed in material weathered from the underlying shale or siltstone, either in place or washed in from adjacent slopes. They are on foot slopes and in swales.

In a representative profile the surface layer is dark-gray silt loam about 4 inches thick. The subsoil, about 18 inches thick, is very dark gray silty clay loam in the upper part, dark grayish-brown silty clay in the middle part, and calcareous, light brownish-gray silty clay loam in the lower part. The middle part is very hard when dry and very firm when moist. The underlying material is calcareous, light-gray loam to a depth of 32 inches. Below this is calcareous, light brownish-gray and gray, soft shale.

Blackpipe soils are medium in organic-matter content and fertility. Permeability is moderately slow, and surface runoff is slow to moderate. Many areas receive additional moisture in the form of runoff from adjacent soils. Available water capacity is low to medium.

Many areas are in native grass and are used for grazing and hay. Wheat, sorghum, and alfalfa are the main crops.

Representative profile of Blackpipe silt loam in an area of Norrest-Blackpipe silt loams, 2 to 5 percent slopes, 660 feet west and 300 feet north of the southeast corner of sec. 18, T. 43 N., R. 31 W.:

A1—0 to 4 inches, dark-gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) moist; weak platy structure and weak, fine, granular; soft, friable; neutral; abrupt, smooth boundary.

B21t—4 to 12 inches, very dark gray (10YR 3/1) silty clay loam, very dark brown (10YR 2/2) moist; moderate, fine and medium, prismatic structure parting to weak, medium, subangular blocky and blocky; hard, friable; many fine pores; neutral; clear, smooth boundary.

B22t—12 to 17 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) crushing to dark grayish brown (10YR 4/2) moist; few medium tongues of very dark brown (10YR 2/2) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; very hard, very firm, very sticky and very plastic; thin, continuous clay films; mildly alkaline; clear, smooth boundary.

B3—17 to 22 inches, light brownish-gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) crushing to light brownish gray (10YR 6/2) moist; weak, medium, prismatic structure parting to moderate, medium, blocky; hard, friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline; gradual, irregular boundary.

C1ca—22 to 32 inches, light gray (10YR 7/2) loam, grayish brown (10YR 5/2) crushing to light brownish gray (10YR 6/2) moist; weak, coarse, prismatic structure parting to weak, coarse, blocky; slightly hard, friable; few fine segregations of lime; violent effervescence; moderately alkaline; gradual, smooth boundary.

C2—32 to 60 inches, light brownish-gray (10YR 6/2) and gray (5Y 5/1), soft shale; weak, very coarse, prismatic structure parting to coarse blocky fragments; hard, friable; mass crumbles readily on wetting; violent effervescence; strongly alkaline.

The depth to soft, but brittle siltstone or mudstone shale ranges from 20 to 40 inches. The A horizon ranges from very dark gray to grayish brown in hue of 10YR and from 3 to 7 inches in thickness. It is silt loam or silty clay loam. The B horizon in some profiles contains thin lenses of silt. The B2t horizon is silty clay loam, silty clay, or clay and has a clay content that ranges from 35 to 50 percent. This horizon ranges from 9 to 18 inches in thickness. The B3 and C1ca horizons are silty clay loam, clay loam, silt loam, and loam. They contain few to many fine particles of siltstone and shale that do not soften when wet. The C1ca horizon contains common to many segregations of lime. The C2 horizon is 10YR, 2.5Y, or 5Y in hue.

Blackpipe soils are near or are mapped with Cedar Butte, Duroc, Hisle, Norrest, Okreek, Wanblee, and Wortman soils. They lack an A2 horizon and contain less sodium than Cedar Butte, Hisle, Wanblee, and Wortman soils. They have a thinner A horizon than Duroc soils. They have darker colored A and B horizons than Norrest soils. They are less clayey than Okreek soils.

Blackpipe soils (0 to 2 percent slopes) (Bp).—These soils are on uplands, in swales, on foot slopes, and along drainageways. They have a profile similar to the one described as representative of the series, but in some areas the surface layer is silty clay loam.

Included in the areas mapped are tracts of Cedar Butte, Duroc, Hisle, Norrest, Okreek, Wanblee, and Wortman soils. Tracts of Cedar Butte, Hisle, Wanblee, and Wortman soils are along drainageways or are scattered throughout the mapped areas. Duroc soils are in lower parts of some areas. Norrest and Okreek soils are on slight rises. These inclusions make up 20 to 40 percent of a given mapped area.

These Blackpipe soils have slow surface runoff. Many areas receive additional moisture in the form of runoff from adjacent soils. Conserving moisture is the main concern in management. Some of the included soils have poor tilth and slow to very slow permeability. Improving tilth and water intake is a management concern in those parts of the mapping unit.

Many areas are in native grass and are used for grazing or hay. Winter wheat, sorghum, and alfalfa are the main crops. Silty range site; capability unit IIc–2; windbreak group 3.

Buffington Series

The Buffington series consists of deep, well-drained, nearly level silty soils on low terraces and high bottoms along streams. These soils formed in silty to clayey alluvium.

In a representative profile the surface layer is silty clay loam about 16 inches thick. The upper part is gray, and the lower part is grayish brown. Below a depth of 8 inches the soil is calcareous and is very hard when dry and very firm when moist. The underlying material to a depth of 40 inches is calcareous, grayish-brown silty clay and silty clay loam. Below a depth of 40 inches it is calcareous, gray silt loam.

Buffington soils are medium in fertility and organic-matter content. Permeability is moderately slow, and surface runoff is slow. Normally the soil is not subject to flooding. Available water capacity is high.

Many areas are in native grass and are used for grazing and hay. Alfalfa, wheat, and sorghum are the main crops.

Representative profile of Buffington silty clay loam, 2,505 feet west and 405 feet south of the northeast corner of sec. 22, T. 44 N., R. 33 W.:

A11—0 to 3 inches, gray (10YR 5/1) light silty clay loam, very dark brown (10YR 2/2) moist; weak, fine, gran-

ular structure; slightly hard, friable; neutral; clear, smooth boundary.

A12—3 to 8 inches, grayish-brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; weak, medium, prismatic structure parting to weak, medium and fine, subangular blocky; hard, firm; mildly alkaline; gradual, smooth boundary.

A13—8 to 16 inches, grayish-brown (2.5Y 5/2) heavy silty clay loam, very dark grayish brown (2.5Y 3/2) moist; weak, coarse, prismatic structure parting to weak, coarse, subangular blocky; very hard, very firm; strong effervescence; moderately alkaline; gradual, smooth boundary.

C1—16 to 25 inches, grayish-brown (2.5Y 5/2) light silty clay, very dark grayish brown (2.5Y 3/2) crushing to dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure; very hard, firm; common fine threads of segregated lime; strong effervescence; moderately alkaline; gradual, smooth boundary.

C2—25 to 40 inches, grayish-brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure; hard, firm; common fine threads of segregated lime; strong effervescence; moderately alkaline; diffuse, smooth boundary.

C3—40 to 60 inches, light-gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; weak, very coarse, prismatic structure; slightly hard, friable; strong effervescence; moderately alkaline.

In some areas the entire profile is calcareous. The A horizon commonly ranges from dark gray to grayish brown in hues of 10YR or 2.5Y, but in a few places, recently deposited sediments of light gray or light brownish gray are on the surface. This horizon ranges from 9 to 20 inches in thickness and from silt loam to silty clay or clay in texture. The C horizon in places contains the surface layer of a buried soil.

In some areas Buffington soils are near Haverson and Kyle soils. They are mapped with Minatare soils. They are more clayey throughout the profile than Haverson soils and are less clayey than Kyle soils. Compared with Minatare soils, they are better drained and do not have the A2 and B2t horizons that are typical of those soils.

Buffington silty clay loam (0 to 3 percent slopes) (Br).—This soil is on high bottoms or low terraces along small creeks in all parts of the county It has the profile described as representative of the series.

Included with this soil in mapping are areas of Haverson soils near stream channels and areas of Buffington soils that have a surface layer of silty clay or clay.

Surface runoff is slow, and permeability is moderately slow. Conserving moisture and controlling soil blowing are the main concerns in management.

Many areas are in native grass and are used for grazing or hay. Some of the larger areas are cultivated. Alfalfa, winter wheat, and sorghum are the main crops. Silty range site; capability unit IIc–2; windbreak group 3.

Buffington silty clay loam, channeled (0 to 5 percent slopes) (Bs).—This soil occurs as long, narrow bands that are dissected by drainage channels and cut into small tracts. Slopes are dominantly less than 3 percent.

Included with this soil in mapping are areas of Haverson soils, which occur near the channels.

Surface runoff is slow. Flooding is a hazard in areas near the channels. Cultivation and haying are impractical in many narrow, irregularly shaped areas. Controlling streambank erosion is a major concern in management.

All the acreage is in native grass and is used for grazing. Overflow range site; capability unit VIw–1; windbreak group 10.

Buffington silty clay (0 to 3 percent slopes) (Bt).—This soil is on low terraces and foot slopes in stream valleys. Its profile is similar to the one described as representative of the series, but the surface layer is silty clay. In some areas nearest to the stream, the surface layer is silty clay loam or silt loam.

Surface runoff is slow, but the soil is not subject to flooding. Water intake is slower in this soil than in Buffington silty clay loam. Improving tilth in the surface layer and increasing the rate of water intake are the main concerns in management of cultivated areas.

Most of the acreage is in native grass and is used for grazing or hay. Alfalfa, winter wheat, and sorghum are the main crops. Clayey range site; capability unit IIIs–3; windbreak group 4.

Buffington silty clay, channeled (0 to 3 percent slopes) (Bu).—Areas of this soil are long and narrow and are dissected by stream channels into small, isolated tracts. The profile is similar to the one described as representative of the series, but the surface layer is mostly silty clay.

Included with this soil in mapping are areas of Haverson soils, which are along the channels in some areas.

Surface runoff is slow. Areas near the channels are subject to flooding. Cultivation and haying are impractical in many narrow, irregularly shaped areas. Controlling streambank erosion is a major concern in management.

Almost all the acreage is in native grass and is used for grazing. Overflow range site; capability unit VIw–1; windbreak group 10.

Buffington clay (0 to 2 percent slopes) (Bv).—This soil is on terraces along small streams or drainageways that flow out of Badland. Areas are small. The profile of this soil is similar to the one described as representative of the series, but the surface layer is mostly clay and the underlying material below a depth of 40 inches ranges from clay to sand. In places the material below a depth of 40 inches is siltstone or shale.

Tilth deteriorates in cultivated areas. Cultivation is impractical because many tracts are small and inaccessible. Improving tilth and increasing the intake of water are the main concerns in management.

Almost all the acreage is in native grass and is used for grazing. Clayey range site; capability unit IIIs–3; windbreak group 4.

Buffington soils, channeled (0 to 3 percent slopes) (Bw).—Areas of these soils are long and narrow and are along drainageways that flow in or out of Badland. Deep, vertically walled channels dissect the narrow areas into many nearly level tracts. The profile of these soils is similar to the one described as representative of the series, but the surface layer ranges from clay to silt loam.

Included with these soils in mapping are low-lying areas of Haverson and Stirk soils along the channels.

Many areas are inaccessible to machinery for cultivation or haying, but usually are accessible to livestock for grazing. Channel stabilization and control of streambank erosion are the main concerns in management.

All the acreage is in native grass and is used for grazing. Overflow range site; capability unit VIw–1; windbreak group 10.

Buffington-Minatare complex (0 to 3 percent slopes) (Bx).—This mapping unit is 70 to 80 percent Buffington

soil and 20 to 30 percent Minatare soil. The Buffington soil has a profile similar to the one described as representative of its series, but the surface layer is clay or silty clay in some areas. The Minatare soil is in slight depressions. It has the profile described as representative of the Minatare series.

Included with these soils in mapping are some areas of Hisle and Wanblee soils along drainageways or on foot slopes below adjacent sloping soils.

Surface runoff is slow. Permeability is moderately slow in the Buffington soil and very slow in the Minatare soil. Tilth deteriorates readily under cultivation. Improving tilth and water intake is a concern in management.

Most of the acreage is in native grass and is used for grazing or hay. Alfalfa and small grain are the main crops in the few areas under cultivation. Minatare soils are not suitable for cultivation. Buffington soil in Clayey range site, capability unit IIIs–3, windbreak group 3; Minatare soil in Thin Claypan range site, capability unit VIs–1, windbreak group 10.

Caputa Series

The Caputa series consists of deep, well-drained, gently sloping to sloping loamy soils on uplands. These soils formed in old alluvium that had been modified or redeposited by wind.

In a representative profile the surface layer is very dark grayish-brown loam about 3 inches thick. The subsoil, about 21 inches thick, is clay loam that is very dark grayish brown in the upper part, dark grayish brown in the middle part, and grayish brown in the lower part. The upper part is very hard to extremely hard when dry and very firm when moist. The lower part is calcareous. The underlying material is calcareous, light brownish-gray and light-gray clay loam.

Caputa soils are medium in fertility and organic-matter content. Permeability is moderately slow, and surface runoff is moderate. Available water capacity is high.

Many areas are in native grass and are used for grazing and hay. Wheat, alfalfa, and sorghum are the main crops.

Representative profile of Caputa loam, 5 to 9 percent slopes, 960 feet north and 540 feet west of the southeast corner of sec. 32, T. 44 N., R. 31 W.:

A1—0 to 3 inches, very dark grayish-brown (10YR 3/2) loam, very dark brown (10YR 2/2) crushing to very dark grayish brown (10YR 3/2) moist; weak, fine, granular and subangular blocky structure; hard, firm; neutral; abrupt, smooth boundary.

B21t—3 to 7 inches, very dark grayish-brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) crushing to very dark grayish brown (10YR 3/2) moist; moderate, fine, prismatic structure parting to moderate, medium, blocky; very hard, very firm; thin, continuous clay films; neutral; clear, smooth boundary.

B22t—7 to 11 inches, very dark grayish-brown (10YR 3/2) heavy clay loam crushing to dark grayish brown (10YR 4/2), very dark brown (10YR 2/2) crushing to very dark grayish brown (10YR 3/2) moist; strong, fine and coarse, prismatic structure parting to moderate, medium, blocky; extremely hard, very firm; thin, continuous clay films; mildly alkaline; clear, smooth boundary.

B23t—11 to 16 inches, dark grayish-brown (10YR 4/2) clay loam crushing to grayish brown (10YR 5/2), very dark grayish brown (10YR 3/2) crushing to dark grayish brown (10YR 4/2) moist; strong, coarse, prismatic structure; very hard, very firm; thin, continuous clay films; mildly alkaline; abrupt, wavy boundary.

B3ca—16 to 24 inches, grayish-brown (10YR 5/2) clay loam crushing to light brownish gray (10YR 6/2), dark grayish brown (10YR 4/2) moist; moderate, coarse, prismatic structure; hard, firm; thin, patchy clay films; many medium segregations of lime; strong effervescence; moderately alkaline; gradual, smooth boundary.

C1ca—24 to 35 inches, light brownish-gray (10YR 6/2) light clay loam, grayish brown (10YR 5/2) moist; weak, coarse, prismatic structure; hard, firm; many medium segregations of lime; strong effervescence; moderately alkaline; gradual, smooth boundary.

C2—35 to 60 inches, light-gray (10YR 7/2) light clay loam, brown (10YR 5/3) moist; massive; hard, friable; strong effervescence; strongly alkaline.

Depth to lime ranges from 10 to 22 inches. The A horizon is commonly loam, but ranges from light clay loam to sandy loam. It ranges from 2 to 7 inches in thickness. The B2t horizon is clay loam or clay and ranges from 35 to 45 percent in clay content. It ranges from 8 to 15 inches in thickness. The B3ca and C1ca horizons contain common to many segregations of lime. The C horizon ranges from sandy clay loam to clay and commonly contains flakes or fragments of soft shale. In places soft bedded shale is between depths of 40 and 60 inches.

Caputa soils are mapped with Opal soils, are near Millboro, Promise, Reliance, and Tuthill soils, and resemble Savo soils. They are less clayey than Opal, Millboro, and Promise soils. They are less silty than Reliance and Savo soils. Their B horizon is more clayey and less sandy than that of Tuthill soils.

Caputa loam, 2 to 5 percent slopes (CaB).—This soil is on uplands in the northern and eastern parts of the county. It has a profile similar to the one described as representative of the series, but its surface layer is thicker.

Included with this soil in mapping are scattered areas of Opal and Promise soils.

Surface runoff is moderate, and permeability is moderately slow. Controlling water erosion and soil blowing is the main concern in management.

Winter wheat, sorghum, and alfalfa are the main crops. Some areas are in native grass and are used for grazing or hay. Silty range site; capability unit IIe–1; windbreak group 3.

Caputa loam, 5 to 9 percent slopes (CaC).—This soil is on uplands. It has the profile described as representative of the series.

Included with this soil in mapping are scattered areas of Opal and Promise soils. These areas are where the mantle of deposited material thins out and the underlying material is clay shale.

Surface runoff is moderate. Controlling water erosion and soil blowing is the main concern in management.

Many areas are in native grass and are used for grazing or hay. Winter wheat, sorghum, and alfalfa are the main crops. Silty range site; capability unit IIIe–1; windbreak group 3.

Cedar Butte Series

The Cedar Butte series consists of deep, moderately well drained and well drained, nearly level to gently sloping silty soils that have a claypan subsoil. These soils are on foot slopes and along drainageways on up-

lands. They formed in alluvium washed in from adjacent clayey soils.

In a representative profile the surface layer is light brownish-gray silt loam about 6 inches thick. The subsoil, about 11 inches thick, is clay that is very dark grayish brown in the upper part, dark grayish brown in the middle part, and light brownish gray and grayish brown in the lower part. The upper part is extremely hard when dry and extremely firm when moist. The lower part is calcareous. The underlying material to a depth of 42 inches is calcareous, light brownish-gray silty clay. Below this is calcareous, pale-brown gravelly sand over bedded shale, which is at a depth of 60 inches.

Cedar Butte soils are moderately low in organic-matter content and medium to low in fertility. Permeability is slow to very slow, and surface runoff is slow to moderate. Available water capacity is low to medium.

Most areas are in native grass and are used for grazing. Wheat and alfalfa are the main crops in the few areas that are cultivated.

Representative profile of Cedar Butte silt loam in an area of Norrest-Cedar Butte silt loams, 3 to 9 percent slopes, 2,080 feet south and 1,320 feet east of the northwest corner of sec. 24, T. 42 N., R. 32 W.:

A21—0 to 4 inches, light brownish-gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, very fine, platy structure and weak, fine, granular; slightly hard, very friable; mildly alkaline; abrupt, smooth boundary.

A22—4 to 6 inches, light brownish-gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, very fine, platy structure; slightly hard, very friable; vesicular pores; mildly alkaline; abrupt, wavy boundary.

B21t—6 to 8 inches, very dark grayish-brown (10YR 3/2) clay, very dark brown (10YR 2/2) moist; strong, fine, columnar structure; extremely hard, extremely firm, very sticky and very plastic; light-gray (10YR 7/2) coatings of silt loam on tops of columns, dark grayish brown (10YR 4/2) moist; mildly alkaline; abrupt, smooth boundary.

B22t—8 to 12 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) crushing to dark grayish brown (10YR 4/2) moist; moderate, medium, prismatic structure parting to weak, medium, blocky; extremely hard, extremely firm, very sticky and very plastic; thin, distinct, continuous clay films; moderately alkaline; clear, smooth boundary.

B3ca—12 to 17 inches, light brownish-gray (10YR 6/2) and grayish-brown (10YR 5/2) clay, grayish brown (10YR 5/2) moist; weak, coarse, prismatic structure parting to weak, medium, blocky; very hard, very firm, slightly sticky and plastic; thin, distinct, mostly continuous clay films; few fine segregations of lime; strong effervescence; strongly alkaline; gradual, smooth boundary.

C1ca—17 to 42 inches, light brownish-gray (10YR 6/2) silty clay, grayish brown (10YR 5/2) moist; weak, coarse, prismatic structure; very hard, very firm, sticky and plastic; few to many fine segregations of lime; strong effervescence; strongly alkaline; clear, smooth boundary.

IIC2ca—42 to 60 inches, pale-brown (10YR 6/3) gravelly sand, dark grayish brown (10YR 4/2) moist; single grained; loose; many pebbles coated with hard crust of lime; slight effervescence; moderately alkaline; abrupt, wavy boundary.

IIIC3—60 to 65 inches, green, olive, and red bedded shale.

Depth to lime ranges from 10 to 24 inches. The A horizon is light brownish gray or light gray in hue of 10YR and is commonly silt loam, but ranges from loam to silty clay loam. It ranges from 4 to 8 inches in thickness. The B2t horizon ranges from very dark grayish brown to grayish brown in hues of 10YR or 2.5Y. It is clay or silty clay, ranges from 6 to 16 inches in thickness, and has moderate to strong and fine to medium columnar structure. The B3 and C horizons in some places contain segregations of salts. The C horizon to a depth of 40 inches is clay, silty clay, or silty clay loam. Below a depth of 40 inches the C horizon is clay, silty clay, gravelly sand, sand, or multicolored shale.

Cedar Butte soils are near Blackpipe, Hisle, Larvie, Metre, Norrest, and Orella soils. They are deeper over shale, mudstone, or siltstone than those soils. In addition they have a thicker A horizon than Hisle soils. They have a columnar structured B horizon that is lacking in the Blackpipe, Larvie, Metre, Norrest, and Orella soils. They have a lighter colored A horizon than Mosher and Wortman soils, which also have a columnar structured B horizon.

Cedar Butte association (0 to 6 percent slopes) (Ce).—This mapping unit is 60 to 80 percent Cedar Butte soils. Many areas are on terraces along creeks and drainageways in the western part of the county. The profile of these soils is similar to the one described as representative of the series, but in places the surface layer is silty clay loam. The Hisle soil, the most extensive of the other soils in this mapping unit, has a profile similar to the one described as representative of that series, but in places it is more than 40 inches deep over shale.

Included in the areas mapped, on the better drained rises, are tracts of Blackpipe, Larvie, Metre, and Norrest soils.

Cedar Butte and Hisle soils have poor tilth and slow to very slow permeability. Surface runoff is slow to moderate. Available water capacity is low in the Hisle soil and low to medium in the Cedar Butte soil. The dense claypan subsoil restricts root growth. Improving tilth and water intake is the main concern in management.

Most areas are in native grass and are used for grazing. Small grain and alfalfa are the main crops. Claypan range site; capability unit IVs–3; windbreak group 9.

Conata Series

The Conata series consists of shallow, well-drained to excessively drained, sloping to steep clayey soils on uplands. These soils formed in material weathered from the underlying mudstone.

In a representative profile the surface layer is brown and reddish-gray clay about 6 inches thick. The subsoil, about 11 inches thick, is calcareous clay that is pinkish gray in the upper part and multicolored in the lower part. It is very hard when dry and firm to very firm when moist. Below this is yellow, light-gray, white, and light reddish-brown mudstone.

Conata soils are moderately low in organic-matter content and low in fertility. Permeability is very slow, and surface runoff is moderate to rapid. Available water capacity is very low.

All areas are in native grass and are used for grazing.

Representative profile of Conata clay in an area of Larvie-Conata clays, 6 to 16 percent slopes, 2,200 feet south and 1,580 feet east of the northwest corner of sec. 18, T. 43 N., R. 31 W.:

A11—0 to 1 inch, brown (7.5YR 5/2) clay, dark brown (7.5YR 4/2) moist; moderate, fine, subangular blocky structure and moderate, fine, granular; very hard, firm,

slightly sticky and slightly plastic; ¼- to ½-inch fragile mulch on surface; mildly alkaline; abrupt, smooth boundary.

A12—1 to 6 inches, reddish-gray (5YR 5/2) clay, dark reddish gray (5YR 4/2) moist; weak, fine, prismatic structure parting to weak, fine, subangular blocky; very hard, firm, sticky and plastic; mildly alkaline; clear, smooth boundary.

B2—6 to 12 inches, pinkish-gray (5YR 6/2) clay, reddish brown (5YR 5/3) moist; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky; very hard, firm, sticky and plastic; many very fine fragments of shale; few, fine, pale-brown (10YR 6/3) segregations of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

B3ca—12 to 17 inches, variegated pinkish-gray (5YR 6/2), light reddish-brown (5YR 6/3), and very pale brown (10YR 7/4) clay, reddish gray (5YR 5/2), reddish brown (5YR 5/3), and yellowish brown (10YR 5/6) moist; weak, medium and coarse, prismatic structure parting to weak, medium and coarse, subangular blocky; very hard, very firm, sticky and plastic; many very fine fragments of shale; common white coatings and fine segregations of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

C—17 to 30 inches, variegated yellow (10YR 7/6), light-gray (10YR 7/1), white (10YR 8/1), and light reddish-brown (5YR 6/3) mudstone, brownish yellow (10YR 6/6), gray (10YR 6/1), and reddish brown (5YR 5/3) moist; strong effervescence; moderately alkaline.

Depth to mudstone or soft shale ranges from 10 to 20 inches. Colors range from 10YR through 5Y in hue. The A horizon is clay or silty clay and ranges from 3 to 7 inches in thickness. The B2 horizon has weak to moderate structure. The B2 and B3ca horizons combined range from 7 to 13 inches in thickness. The B horizon contains few to many fine or very fine fragments of weathered shale.

Conata soils are mapped with Imlay and Larvie soils and are near Epping and Orella soils. They have a B horizon and are more clayey than Epping and Imlay soils and less alkaline than Orella soils. They are more shallow over mudstone or shale than Larvie soils.

Conata-Larvie clays, 9 to 25 percent slopes (CIE).—This mapping unit is 60 to 70 percent Conata soil and 30 to 40 percent Larvie soil. The Conata soil occupies the higher parts of the landscape, and the Larvie soil, commonly less steep than the Conata soil, the lower parts.

These soils are not suitable for cultivation. Surface runoff is moderate to rapid. Erosion is a hazard in areas where vegetation is sparse.

All areas are in native grass and are used for grazing. Capability unit VIs–3; windbreak group 10; Conata soil in Shallow range site, Larvie soil in Clayey range site.

Dunday Series

The Dunday series consists of deep, somewhat excessively drained, nearly level to rolling sandy soils on uplands. These soils formed in eolian sand.

In a representative profile the surface layer is dark grayish-brown loamy fine sand about 10 inches thick. Below this is a transition layer of about 4 inches of brown loamy fine sand that is soft when dry and loose when moist. The underlying material is pale-brown fine sand.

Dunday soils are moderately low in organic-matter content and low in fertility. Permeability is rapid, and surface runoff is very slow. Available water capacity is low.

All areas are in native grass and are used for grazing or hay.

Representative profile of Dunday loamy fine sand in an area of Dunday and Anselmo soils, 0 to 6 percent slopes, 210 feet east and 15 feet south of the northwest corner of sec. 21, T. 40 N., R. 32 W.:

A11—0 to 3 inches, dark grayish-brown (10YR 4/2) loamy fine sand, very dark brown (10YR 2/2) crushing to very dark grayish brown (10YR 3/2) moist; weak, very fine, granular structure parting to single grained; soft, very friable; neutral; abrupt, smooth boundary.

A12—3 to 10 inches, dark grayish-brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak, coarse, prismatic structure parting to weak, medium and coarse, subangular blocky; soft, loose; neutral; clear, smooth boundary.

AC—10 to 14 inches, brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; weak, coarse, prismatic structure parting to weak, coarse, subangular blocky and single grained; loose; neutral; gradual, smooth boundary.

C—14 to 60 inches, pale-brown (10YR 6/3) fine sand, dark brown (10YR 4/3) moist; single grained; loose; neutral.

The A horizon is dark grayish brown or grayish brown in hue of 10YR. It is loamy fine sand or fine sandy loam and ranges from 8 to 16 inches in thickness. The AC horizon is as much as 10 inches thick in some places, but does not occur in others. The C horizon is fine- to coarse-textured sand and commonly contains sand-size fragments of shale or siltstone. In places shale, siltstone, or gravel is below a depth of 40 inches.

Dunday soils are mapped with Anselmo and Valentine soils. They are sandier than Anselmo soils and have a thicker A horizon than Valentine soils.

Dunday loamy fine sand, 6 to 9 percent slopes (DsC).—This undulating soil is on uplands. It has a profile similar to the one described as representative of the series, but in places the material below a depth of 40 inches is shale, mudstone, siltstone, or gravel.

Included with this soil in mapping are areas of Anselmo, Manter, Tuthill, and Valentine soils. Anselmo, Manter, and Tuthill soils occupy the smooth, more stable slopes. Valentine soils are near the crests of rises or in parts of the areas mantled with more recent deposits of sand. Also included in some areas where the mantle of sand is thin are Cedar Butte, Conata, Huggins, Larvie, Norrest, and Opal soils.

This Dunday soil absorbs water rapidly and has very slow surface runoff. It is subject to blowing if the vegetative cover is disturbed. The main concern in management is controlling soil blowing.

Most areas are in native grass and are used for grazing. Sands range site; capability unit VIe-7; windbreak group 10.

Dunday and Anselmo soils, 0 to 6 percent slopes (DtB).—Some areas of this mapping unit are mainly Dunday soil, some are mainly Anselmo soil, and some contain both soils. The Dunday soil has shorter slopes and is more undulating than the Anselmo soil. It has the profile described as representative of the series. The Anselmo soil is described under the heading "Anselmo series."

Included with these soils in mapping are areas of Manter, Tuthill, and Woodly soils. Manter and Tuthill soils are on the lower parts of rises, and Woodly soils

are in swales and along drainageways. Also included in some areas where the mantle of wind-deposited sand is thin, are one or more silty or clayey soils, depending on the kind of underlying material. Inclusions make up 20 to 30 percent of a given mapped area.

Dunday and Anselmo soils absorb water readily. They are highly susceptible, however, to blowing. Controlling soil blowing is the main concern in management.

Most areas are in native grass and are used for grazing or hay. Dunday soil in Sands range site, capability unit VIe–7, windbreak group 10; Anselmo soil in Sandy range site, capability unit IIIe–8, windbreak group 5.

Dunday and Valentine soils, 9 to 15 percent slopes (DuD).—Some areas of this mapping unit are mainly Dunday soil, some are Valentine soil, and some contain both soils. Slopes are short. The Dunday soil is on the mid and lower slopes, and the Valentine soil is on the higher and steeper parts of the well-rounded ridges and knolls. See "Valentine Series" for a description of the Valentine soil.

Included with these soils in mapping are areas of Anselmo, Manter, and Woodly soils, mostly in swales and low places, and one or more silty or clayey soils in places where the mantle of sand is thin and the underlying material is siltstone or shale.

Dunday and Valentine soils are highly susceptible to blowing. They take in water readily and have very slow surface runoff. Available water capacity is low.

All areas are in native grass and are used for grazing. Sands range site; capability unit VIe–7; windbreak group 10.

Duroc Series

The Duroc series consists of deep, moderately well drained and well drained, nearly level to gently sloping silty soils in swales and on foot slopes of the uplands. These soils formed in alluvium washed in from adjacent slopes.

In a representative profile the surface layer is dark grayish-brown heavy silt loam about 13 inches thick. The subsoil, about 16 inches thick, is light silty clay loam that is dark brown in the upper part and pinkish gray and dark brown in the lower part. It is slightly hard to hard when dry and friable when moist. The underlying material is pinkish-gray silt loam and loam to a depth of 44 inches. Below this is pink, soft siltstone and loam.

Duroc soils are high in organic-matter content and fertility. Permeability is moderate, and surface runoff is slow to moderate. Some parts of most areas receive additional moisture in the form of runoff from adjacent soils. Available water capacity is medium to high.

Many areas are cultivated. Wheat, sorghum, and alfalfa are the main crops. Other areas are in native grass and are used for grazing and hay.

Representative profile of Duroc silt loam in an area of Duroc and Kadoka silt loams, 2 to 5 percent slopes, 1,560 feet south and 150 feet west of the northeast corner of sec. 22, T. 40 N., R. 33 W.:

Ap—0 to 5 inches, dark grayish-brown (10YR 4/2) heavy silt loam, very dark brown (10YR 2/2) moist; cloddy; weak, fine, platy and granular structure; slightly hard, very friable; slightly acid; abrupt, smooth boundary.

A12—5 to 13 inches, dark grayish-brown (10YR 4/2) heavy silt loam, very dark brown (10YR 2/2) moist; weak, medium, prismatic structure parting to weak, medium, subangular blocky; slightly hard, friable; neutral; clear, smooth boundary.

B2—13 to 22 inches, dark-brown (7.5YR 4/2) light silty clay loam, very dark brown (7.5YR 2/2) moist; weak, medium, prismatic structure parting to weak, medium, subangular blocky; slightly hard, friable; thin, patchy clay films; neutral; clear, wavy boundary.

B3—22 to 29 inches, pinkish-gray (7.5YR 6/2) and dark-brown (7.5YR 4/2) light silty clay loam, dark brown (7.5YR 3/2) crushing to (7.5YR 4/2) moist; weak, coarse, prismatic structure parting to weak, fine, blocky and subangular blocky; hard, friable; neutral; gradual, smooth boundary.

C1—29 to 38 inches, pinkish-gray (7.5YR 7/2) silt loam, brown (7.5YR 5/3) crushing to light brown (7.5YR 6/3) moist; weak, coarse, prismatic structure; slightly hard, friable; neutral; gradual, smooth boundary.

C2—38 to 44 inches, pinkish-gray (7.5YR 7/2) loam, light brown (7.5YR 6/3) moist; massive; slightly hard, friable; few hard bits of siltstone; slight effervescence; moderately alkaline; gradual, smooth boundary.

IIC3—44 to 60 inches, pink (7.5YR 7/2), soft siltstone and loam, brown (7.5YR 5/3) moist; bedded; soft, very friable; siltstone crushes easily to loam but contains fragments that are very hard; slight effervescence; moderately alkaline.

The A horizon ranges from dark brown to grayish brown in hues of 10YR and 7.5YR. It is commonly silt loam, but ranges from loam to silty clay loam. Horizons that are very dark grayish brown or darker when moist range from 20 to 40 inches in thickness. Siltstone is below a depth of 5 feet in many places.

Duroc soils are mapped with Kadoka soils and are near Kube soils. They have a thicker A horizon than Kadoka and Kube soils. They are more silty than Keya and Woodly soils, which also have a thick A horizon.

Duroc and Kadoka silt loams, 0 to 2 percent slopes (DvA).—Some areas of this mapping unit are dominantly Duroc soil, some are dominantly Kadoka soil, and some contain both soils in proportions that differ from one area to another. The landscape is one of upland flats and basins surrounded by gentle slopes. The Duroc soil is in swales and in broad, slight depressions along drainageways. The Kadoka soil is on slight rises. It is described under the heading "Kadoka Series."

Included with these soils in mapping are small areas of Blackpipe, Kube, Mosher, and Wortman soils.

Duroc and Kadoka soils are medium to high in fertility and have good tilth. Surface runoff is slow. Some areas of the Duroc soil receive additional moisture in the form of runoff from adjacent soils. Conserving moisture is the main concern in management.

Most of the larger areas are cultivated. Winter wheat, sorghum, and alfalfa are the main crops. Smaller tracts are in native grass and are used for grazing or hay. Silty range site; capability unit IIc–2; windbreak group 3.

Duroc and Kadoka silt loams, 2 to 5 percent slopes (DvB).—These gently sloping soils are on foot slopes below adjacent strongly sloping soils. Some areas are dominantly Duroc soil, some are dominantly Kadoka soil, and some contain both soils in proportions that differ from one area to another. The Duroc soil typically has concave slopes. It has the profile described as repre-

sentative of the series. The Kadoka soil is on convex shaped rises. It is described under the heading "Kadoka Series."

Included with these soils in mapping are areas of Blackpipe, Huggins, Tuthill, and Wortman soils. Blackpipe and Huggins soils are near Kadoka soils. Tuthill soils are on rises mantled with sandy material. Wortman soils are in low areas.

Duroc and Kadoka soils have moderate surface runoff. Some areas receive runoff from adjacent soils. Controlling erosion is the main concern in management.

Many of the larger areas are cultivated. Winter wheat, sorghum, and alfalfa are the main crops. Other areas are in native grass and are used for grazing and hay. Silty range site; capability unit IIe–1; windbreak group 3.

Epping Series

The Epping series consists of shallow, well-drained to excessively drained, sloping to steep, calcareous silty soils on uplands. These soils formed in material weathered from the underlying siltstone.

In a representative profile the surface layer is gray silt loam about 3 inches thick. Below this is a transition layer of pinkish-gray silt loam, about 4 inches thick, that is slightly hard when dry and friable when moist. The underlying material to a depth of 18 inches is pinkish-gray, soft siltstone and silt loam. Below a depth of 18 inches is pinkish-gray, soft siltstone.

Epping soils are low in organic-matter content and fertility. Permeability is moderate, but moisture seldom penetrates the bedded siltstone. Surface runoff is rapid, and available water capacity is very low.

Epping soils are not suitable for cultivation. Nearly all areas are in native grass and are used for grazing.

Representative profile of Epping silt loam in an area of Huggins-Epping silt loams, 5 to 15 percent slopes, 420 feet north and 225 feet east of the southwest corner of sec. 26, T. 40 N., R. 33 W.:

A1—0 to 3 inches, gray (7.5YR 6/1) silt loam, dark brown (7.5YR 3/2) crushing to (7.5YR 4/2) moist; weak, very fine, granular structure; soft, friable; few fine bits and particles of siltstone; strong effervescence; moderately alkaline; clear, smooth boundary.

AC—3 to 7 inches, pinkish-gray (7.5YR 6/2) silt loam, brown (7.5YR 5/3) moist; weak, fine, subangular blocky and granular structure; slightly hard, friable; 25 percent bits and fragments of siltstone; strong effervescence; moderately alkaline; clear, smooth boundary.

C1—7 to 18 inches, pinkish-gray (7.5YR 6/2), soft siltstone and silt loam, brown (7.5YR 5/4) moist; bedded siltstone breaks to irregular blocky fragments, and soil fines are of weak, fine, subangular blocky and granular structure; siltstone is hard and brittle, but is crumbly when moist and crushes to silt loam; less than 35 percent silt loam; strong effervescence; moderately alkaline; gradual, wavy boundary.

C2—18 to 60 inches, pinkish-gray (7.5YR 6/2), soft siltstone, brown (7.5YR 5/4) moist; bedded; siltstone hardens when dry, but is crumbly and friable when moist; strong effervescence; moderately alkaline.

Depth to bedded siltstone ranges from 6 to 20 inches. The A horizon ranges from dark brown or dark grayish brown to light gray in hues of 7.5YR or 10YR. It is commonly silt loam, but ranges from loam to light silty clay loam. It is 2 to 6 inches thick. It is noncalcareous in some profiles. The underlying siltstone contains some strata that are hard and brittle when dry and others that are soft and are easily crushed to silt loam.

Epping soils are mapped with Huggins and Keota soils and are generally near Blackpipe, Imlay, Kadoka, Kube, Norrest, and Orella soils. They are shallower over siltstone than Blackpipe, Huggins, Kadoka, Kube, and Norrest soils and do not have the B horizon that is typical of those soils. They are also shallower over siltstone than Keota soils. They are more silty and less clayey than Imlay and Orella soils.

Epping-Huggins silt loams, 5 to 15 percent slopes (EhD).—This mapping unit is at least 50 percent Epping soil, about 30 percent Huggins soil, and about 20 percent other soils. The Epping soil is on the tops and upper sides of ridges. It has a profile similar to the one described as representative of the Epping series, but in places it is less silty and slightly more sandy. The more gently sloping Huggins soil is on the mid and lower parts of the landscape. It is described under the heading "Huggins Series."

Included with these soils in mapping are areas of Duroc, Kadoka, Keota, and Kube soils. Duroc and Kube soils are in swales or along small drainageways. The Kadoka soil is on foot slopes, and the Keota soil is intermingled with the Epping soil.

These Epping and Huggins soils have moderate to rapid surface runoff. Erosion is a severe hazard in areas that lack a vegetative cover. Available water capacity is low, and the soils are droughty. The Epping soil is low in fertility and is too shallow for cultivation.

Almost all areas are in native grass and are used for grazing. Capability unit VIs–2; windbreak group 10. Epping soil in Shallow range site, Huggins soil in Silty range site.

Epping-Huggins silt loams, 15 to 40 percent slopes (EhE).—This mapping unit is 50 to 60 percent Epping soil, 25 percent Huggins soil, and 15 to 25 percent other soils. The Epping soil is on the ridgetops and upper slopes. The less sloping Huggins soil is on ridgetops and lower slopes. It is described under the heading "Huggins Series."

Included with these soils in mapping are areas of Anselmo, Dunday, Imlay, Keota, Manter, Norrest, Schamber, Valentine, and Wanblee soils. Anselmo, Dunday, Manter, and Valentine soils are in scattered spots that are mantled with wind-deposited sandy material. Schamber soils are on gravelly ridges. Imlay and Keota soils are near Epping soils. Norrest soils are on foot slopes, and Wanblee soils are in swales or along drainageways. Also included are small eroded spots similar to Barren badland.

These Epping and Huggins soils have rapid surface runoff. The risk of erosion is high in areas that have a poor vegetative cover. All areas are in native grass and are used for grazing. Capability unit VIIs–1; windbreak group 10; Epping soil in Shallow range site, Huggins soil in Silty range site.

Glenberg Series

The Glenberg series consists of deep, well-drained, nearly level, calcareous loamy soils on flood plains and low terraces along streams. These soils formed in alluvium.

In a representative profile the surface layer is light brownish-gray fine sandy loam about 8 inches thick. The underlying material to a depth of 54 inches is pale-brown and light-gray very fine sandy loam. The upper part is slightly hard when dry and very friable when moist. Below a depth of 54 inches is light-gray fine sand.

Glenberg soils are low in organic-matter content and fertility. Permeability is moderately rapid through the very fine sandy loam and rapid through the fine sand. Surface runoff is slow, and most areas are flooded periodically. Available water capacity is medium to high.

Many areas are in native grass and are used for grazing and hay. Alfalfa, small grain, and corn are the main crops.

Representative profile of Glenberg fine sandy loam, 1,150 feet north and 790 feet west of the southeast corner of sec. 25, T. 44 N., R. 28 W.:

Ap—0 to 8 inches, light brownish-gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; weak, fine, platy and granular structure; slightly hard, very friable; strong effervescence; moderately alkaline; abrupt, smooth boundary.

C1—8 to 20 inches, pale-brown (10YR 6/3) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak, coarse, prismatic structure; slightly hard, very friable; strong effervescence; moderately alkaline; gradual, smooth boundary.

C2—20 to 54 inches, light-gray (10YR 7/2) very fine sandy loam, brown (10YR 5/3) moist; weak, coarse, prismatic structure parting to irregular fragments and to single grained; soft, very friable; strong effervescence; strongly alkaline; diffuse boundary.

C3—54 to 60 inches, light-gray (10YR 7/2) fine sand, dark brown (10YR 4/3) moist; single grained; loose; strong effervescence; very strongly alkaline.

The A horizon ranges from grayish brown to light gray in hues of 10YR or 2.5Y and from 4 to 8 inches in thickness. It is typically fine sandy loam or very fine sandy loam, but in recently flooded areas it is commonly mantled with a layer of silt or clay about 1 inch thick. In some areas the A horizon in noncalcareous. The C horizon to a depth of 40 inches or more ranges from sandy loam to very fine sandy loam and is commonly stratified with thin lenses of sand, silt, or clay. The upper part of the C horizon in places does not have prismatic structure, but is massive or single grained.

Glenberg soils, like Bankard, Buffington, Haverson, and Mitchell soils, are in stream valleys. They are less sandy than Bankard soils and are more sandy and less clayey than Buffington, Haverson, and Mitchell soils.

Glenberg fine sandy loam (0 to 3 percent slopes) (Ge).—This soil is on low terraces along streams, mainly the White and Little White Rivers. It has the profile described as representative of the series.

Included with this soil in mapping are areas of Buffington, Haverson, and Mitchell soils. Haverson soils are in low areas. Buffington and Mitchell soils are in spots where the alluvium contains less sand.

This Glenberg soil is low in organic-matter content and fertility, and it blows easily. Surface runoff is slow. Flooding is rare. The main concern in management is controlling soil blowing.

Many areas are cultivated. Small grain and alfalfa are the main crops. Lower areas are in native grass and are used for grazing. Cottonwood trees in some of the lower areas provide protection in winter for livestock and game animals. Sandy range site; capability unit IIIe–7; windbreak group 2.

Haverson Series

The Haverson series consists of deep, moderately well drained to well drained, nearly level to gently sloping, calcareous silty soils on bottom land. These soils formed in alluvium.

In a representative profile the surface layer is light brownish-gray silty clay loam about 7 inches thick. Below this to a depth of 18 inches is grayish-brown and light-gray silty clay and silt loam. The underlying material to a depth of 58 inches is light-gray and light brownish-gray silt loam stratified with thin bands of silty clay loam. Below a depth of 58 inches the soil is light brownish-gray fine sand.

Haverson soils are moderately low to low in organic-matter content and are low in fertility. Permeability is moderate, and surface runoff is slow. Periodic flooding is a hazard in many areas, but in some, flooding is rare. Available water capacity is high.

Many areas are in native grass and are used for grazing and hay. Scattered trees, mostly cottonwoods, grow in the lower lying areas near stream channels. Wheat, alfalfa, corn, and sorghum are the chief crops.

Representative profile of Haverson silty clay loam, 500 feet north of the center of sec. 35, T. 45 N., R. 32 W.:

A11—0 to 2 inches, light brownish-gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; moderate, medium, subangular blocky structure and moderate, fine, granular; slightly hard, friable; white crust about one-fourth inch thick; slight effervescence; mildly alkaline; abrupt, smooth boundary.

A12—2 to 7 inches, light brownish-gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; weak, fine, platy structure parting to weak, fine, subangular blocky; slightly hard, friable; slight effervescence; mildly alkaline; abrupt, smooth boundary.

A13b—7 to 18 inches, grayish-brown (2.5YR 5/2) and light-gray (2.5Y 7/2) silty clay and silt loam, very dark grayish brown (2.5Y 3/2) and grayish brown (2.5Y 5/2) crushing to grayish brown (2.5Y 5/2) moist; weak, medium, blocky and subangular blocky structure; hard, firm; strong effervescence; moderately alkaline; abrupt, smooth boundary.

C1—18 to 58 inches, light-gray (2.5Y 7/2) silt loam stratified with silty clay loam, light brownish gray (2.5Y 6/2) moist; massive; soft to hard, very friable to firm; strong effervescence; moderately alkaline; gradual, smooth boundary.

IIC2—58 to 60 inches, light brownish-gray (2.5Y 6/3) fine sand, grayish brown (2.5Y 5/3) moist; single grained; loose; strong effervescence; moderately alkaline.

In some places the A horizon is noncalcareous. It is commonly silt loam or silty clay loam, but in some profiles it is loam or very fine sandy loam. It ranges from 3 to 8 inches in thickness and from dark grayish brown to light brownish gray in hues of 2.5Y or 10YR. The dark grayish-brown layer, where present, is typically less than 5 inches thick. The C horizon is commonly silt loam stratified with thin bands of finer and coarser textured material. Fine sand or very fine sand is commonly between depths of 40 to 60 inches. Thin layers of buried soils are common.

Haverson soils are near Buffington, Glenberg, and Mitchell soils. They are less clayey than Buffington soils and more clayey than Glenberg and Mitchell soils.

Haverson silt loam (0 to 3 percent slopes) (Ha).—This soil is on low terraces along creeks. Many areas are small in size and long and narrow in shape. This soil has a profile similar to the one described as representative of the series, but the surface layer is silt loam.

Included with this soil in mapping are areas of Buffington, Mosher, and Minatare soils.

Surface runoff is slow. Flooding is rare. Conserving moisture is the main concern in management.

Most areas are in native grass and are used for grazing. Winter wheat, sorghum, and alfalfa are the main crops in the few areas that are cultivated. Silty range site; capability unit IIc–1; windbreak group 1.

Haverson silt loam, channeled (0 to 6 percent slopes) (Hc).—This soil occurs as long, narrow areas that are cut by meandering channels and divided into small parcels. It is nearly level except in places along the channels and on small tablelike remnants. It has a profile similar to the one described as representative of the series, but the surface layer is silt loam.

Surface runoff is slow. Flooding is a hazard. The channeling in the small areas makes cultivation impractical.

Areas of this soil are in native grass and are used for grazing. Overflow range site; capability unit VIw-1; windbreak group 10.

Haverson silty clay loam (0 to 3 percent slopes) (Hd).—This soil is on bottom land mainly along the White and Little White Rivers. It has the profile described as representative of the series.

Included with this soil in mapping are areas of Buffington and Mitchell soils, which are on levels slightly higher than the Haverson soil.

Areas of this Haverson soil are subject to flooding in some years, but the effects generally are limited to damaged fences and small amounts of sediment and debris. Conserving moisture and controlling soil blowing are the main concerns in management.

Many areas are cultivated. Alfalfa, winter wheat, and sorghum are the main crops. Other areas are in native grass and are used for grazing and hay. Cottonwood trees, which are in the lower lying areas, provide protection for livestock and wildlife. Overflow range site; capability unit IIc–1; windbreak group 1.

Haverson soils (0 to 6 percent slopes) (He).—These soils are mostly nearly level, but in areas along the edge of terraces, slopes range to as much as 6 percent. In some areas the surface layer is silt loam, in others it is silty clay loam, and in a few it is loam. Otherwise the profile is similar to the one described as representative of the series.

Surface runoff is slow. Most areas are subject to flooding or receive runoff water from adjacent sloping soils and Badland. The effects of flooding generally are limited to damaged fences and thin deposits of sediment and debris. Conserving moisture is the main concern in management.

Most areas are in native grass and are used for grazing. Overflow range site; capability unit IIc–1; windbreak group 1.

Hisle Series

The Hisle series consists of moderately deep, moderately well drained to well drained, nearly level to strongly sloping soils on uplands. These soils have a claypan subsoil. They formed in clayey material weathered in place from shale or washed in from adjacent slopes.

In a representative profile the surface layer is gray silt loam about 1 inch thick. The subsoil, about 12 inches thick, is silty clay that is dark grayish brown in the upper part, dark gray in the middle part, and light brownish gray in the lower part. The upper part is very hard when dry and very firm when moist. The underlying material to a depth of 34 inches is calcareous, light-gray silty clay loam. Below this, it is calcareous, gray silty clay and clayey shale.

Hisle soils are moderately low in organic-matter content and are low in fertility. Permeability is very slow, and surface runoff is slow to moderate, depending on the slope. Available water capacity is low.

All areas are in native grass and are used for grazing. Vegetation is sparse in most areas.

Representative profile of Hisle silt loam in an area of Hisle and Orella soils, 0 to 15 percent slopes, 2,080 feet south and 130 feet east of the northwest corner of sec. 24, T. 42 N., R. 32 W.:

A2—0 to 1 inch, gray (10YR 6/1) silt loam, very dark brown (10YR 2/2) crushing to very dark grayish brown (10YR 3/2) moist; weak, fine, granular and subangular blocky structure; soft, very friable; neutral; abrupt, wavy boundary.

B21t—1 to 2 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate, fine, columnar structure parting to moderate, fine, blocky; very hard, very firm, sticky; gray silt caps on column tops; thin, continuous clay films; mildly alkaline; abrupt, wavy boundary.

B22t—2 to 6 inches, dark-gray (10YR 4/1) silty clay, very dark grayish brown (10YR 3/2) crushing to dark grayish brown (10YR 4/2) moist; moderate, medium, prismatic structure parting to moderate, fine and medium, blocky; very hard, very firm, sticky; thin, continuous clay films; strong effervescence; strongly alkaline; clear, smooth boundary.

B23t—6 to 10 inches, dark-gray (10YR 4/1) silty clay, very dark grayish brown (10YR 3/2) crushing to dark grayish brown (10YR 4/2) moist; weak, fine and medium, prismatic structure parting to weak, medium, subangular blocky and weak, fine, blocky; very hard, very firm, sticky; thin, continuous clay films; strong effervescence; strongly alkaline; clear, smooth boundary.

B3—10 to 13 inches, light brownish-gray (10YR 6/2) and dark grayish-brown (10YR 4/2) silty clay, grayish brown (10YR 5/2) and very dark grayish brown (10YR 3/2) crushing to dark grayish brown (10YR 4/2) moist; weak, coarse, prismatic structure parting to weak, medium and coarse, blocky; very hard, very firm, sticky; thin, patchy clay films; strong effervescence; strongly alkaline; gradual, smooth boundary.

C1ca—13 to 34 inches, light-gray (2.5Y 7/2) silty clay loam, light brownish gray (2.5Y 6/2) moist; weak, coarse, prismatic structure in upper part, massive in lower part; slightly hard, friable, sticky; common medium and coarse segregations of lime; violent effervescence; moderately alkaline; clear, smooth boundary.

C2—34 to 60 inches, gray (10YR 6/1), weathered shale and silty clay, dark grayish brown (10YR 4/2) moist; bedded; fine earth is very hard, very firm, sticky; strong effervescence; moderately alkaline.

Depth to bedded shale, siltstone, or mudstone ranges from 20 to 40 inches. Hues range from 7.5YR through 5Y. The A horizon ranges from gray or grayish brown to light gray. It is commonly silt loam, but ranges from loam to silty clay loam. It ranges from less than 1 to 4 inches in thickness. The Bt horizon is silty clay or clay and ranges from 4 to 12 inches in thickness. The C horizon ranges from silty clay loam to clay. The B3 and C horizons commonly contain visible segregations of salts.

Hisle soils are mapped with Orella soils and are near Cedar Butte soils. They have a distinct A2 horizon and a columnar structured B horizon, both of which are lacking in Orella soils. They have a thinner A horizon than Cedar Butte soils.

Hisle and Orella soils, 0 to 15 percent slopes (HID).—Some areas of this mapping unit are mainly Hisle soil, some are mainly Orella soil, and some contain both soils in proportions that differ from one place to another. Gravel is scattered over the surface in many areas. The Orella soil is described under the heading "Orella Series."

Included with these soils in mapping are areas of Blackpipe, Cedar Butte, Larvie, Metre, Norrest, and Okreek soils. Cedar Butte soils are near the Hisle soil. The other inclusions occur in an erratic pattern that differs from one area to another.

Hisle and Orella soils are not suitable for cultivation. They are high in sodium and are strongly alkaline. Fertility is low, and available water capacity is low to very low.

All areas are in native grass and are used for grazing. Hisle soil in Thin Claypan range site, capability unit VIs–1, windbreak group 10; Orella soil in Shallow range site, capability unit VIs–3, windbreak group 10.

Hoven Series

The Hoven series consists of deep, poorly drained, level silty soils in depressions of the uplands. These soils formed in alluvium washed in from adjacent soils.

In a representative profile the surface layer is gray silt loam about 4 inches thick. The subsoil, about 22 inches thick, is gray clay that is extremely hard when dry and very firm when moist. The underlying material is calcareous, gray silty clay to a depth of 40 inches. Below this is calcareous, light brownish-gray and light-gray clay loam.

Hoven soils are medium in organic-matter content and low in fertility. Permeability is very slow, and the soils are frequently ponded. Available water capacity is medium.

The Hoven soils in Mellette County are mapped only with Kolls soils. All areas are in native grass and are used for hay and grazing.

Representative profile of Hoven silt loam in an area of Kolls and Hoven soils, 1,140 feet west and 1,080 feet north of the southeast corner of sec. 20, T. 40 N., R. 29 W.:

A21—0 to 1 inch, gray (10YR 6/1) silt loam, gray (10YR 5/1) moist; few coarse mottles of light olive brown; weak, very fine, platy structure parting to weak, fine, granular; soft, very friable; slightly acid; abrupt, smooth boundary.

A22—1 to 4 inches, gray (10YR 6/1) silt loam, dark gray (10YR 4/1) moist; few fine mottles of brownish yellow; weak, very fine, platy structure; soft, friable; slightly acid; abrupt, wavy boundary.

B21t—4 to 7 inches, gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; moderate, medium, columnar structure; extremely hard, very firm, very sticky and plastic; thin, gray (10YR 6/1) coatings of silt loam on tops and sides of columns, dark gray (10YR 4/1) moist; thin, continuous clay films; slightly acid; abrupt, smooth boundary.

B22t—7 to 14 inches, gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; weak, medium and coarse, prismatic structure parting to weak, medium, blocky; extremely hard, very firm, very sticky and plastic; thin, continuous clay films; neutral; clear, smooth boundary.

B3—14 to 26 inches, gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; weak, coarse, prismatic structure parting to weak, coarse, blocky; extremely hard, very firm, very sticky and plastic; thin, patchy clay films; neutral; gradual, smooth boundary.

C1ca—26 to 40 inches, gray (10YR 6/1) silty clay, dark gray (10YR 4/1) moist; weak, coarse and very coarse, prismatic structure; very hard, very firm, sticky and plastic; common fine masses and striations of segregated lime; strong effervescence; moderately alkaline; diffuse, smooth boundary.

C2—40 to 60 inches, light brownish-gray (2.5Y 6/2) and light-gray (2.5Y 7/2) clay loam, gray (5Y 5/1) and light brownish gray (2.5Y 6/2) moist; massive; hard, friable, sticky and plastic; few fine segregations of lime, gypsum, and other salts; slight effervescence; mildly alkaline.

The A horizon is silt loam or silty clay loam and ranges from 1 to 4 inches in thickness. The B2t horizon is clay or silty clay and ranges from 8 to 20 inches in thickness. The C horizon is commonly silty clay, clay, or clay loam, but in some profiles it is loam, sandy loam, or loamy fine sand below a depth of 40 inches.

Hoven soils are mapped with Kolls soils. In contrast with those soils, they have an A2 horizon, contain more sodium, and are deeper over lime.

Huggins Series

The Huggins series consists of moderately deep, well-drained, nearly level to steep silty soils on uplands. These soils formed in material weathered from the underlying siltstone.

In a representative profile the surface layer is gray silt loam about 3 inches thick. The subsoil, about 11 inches thick, is silty clay loam that is gray in the upper part and light brownish gray and light gray in the lower part. The upper part is hard when dry and firm when moist. The lower part is calcareous and contains many fragments of siltstone. The underlying material to a depth of 22 inches is calcareous, pinkish-gray silty clay loam that contains many fragments of siltstone. Bedded siltstone is below a depth of 22 inches.

Huggins soils are medium in organic-matter content and fertility. Permeability is moderately slow, and surface runoff is moderate. Available water capacity is low.

Representative profile of Huggins silt loam in an area of Epping-Huggins silt loams, 5 to 15 percent slopes, 2,118 feet west and 235 feet south of the northeast corner of sec. 4, T. 41 N., R. 32 W.:

A1—0 to 3 inches, gray (10YR 5/1) silt loam, very dark brown (10YR 2/2) crushing to very dark grayish brown (10YR 3/2) moist; weak, medium, granular and subangular blocky structure; slightly hard, very friable; neutral; abrupt, smooth boundary.

B21t—3 to 7 inches, gray (10YR 5/1) silty clay loam, very dark brown (10YR 2/2) crushing to very dark grayish brown (10YR 3/2) moist; weak, medium, prismatic structure parting to moderate, medium, subangular blocky; hard, firm; thin, continuous clay films; mildly alkaline; clear, smooth boundary.

B22t—7 to 10 inches, light brownish-gray (10YR 6/2) and light-gray (10YR 7/2) heavy silty clay loam, dark brown (10YR 4/3) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; very hard, firm; thin, continuous clay films; 5 to 15 percent bits and fragments of noncalcareous siltstone; mildly alkaline; clear, wavy boundary.

B3—10 to 14 inches, light-gray (10YR 7/2) heavy silty clay loam, dark brown (10YR 4/3) crushing to brown

(10YR 5/3) moist; weak, fine and medium, subangular blocky structure; thin, patchy clay films; 15 to 25 percent bits and fragments of siltstone; slight effervescence; mildly alkaline; clear, wavy boundary.

C1—14 to 22 inches, pinkish-gray (7.5YR 7/2) and light-gray (7.5YR 7/1) gravelly silty clay loam, brown (7.5YR 5/4) moist; massive; hard, friable; 50 percent siltstone fragments; siltstone fragments and irregular blocky fragments of fine earth thinly coated with segregated lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

C2—22 to 60 inches, pinkish-gray (7.5YR 7/2) and white (7.5YR 8/0), soft siltstone, brown (7.5YR 5/4) moist; bedded; breaks into blocky fragments that are hard and brittle when dry, but disintegrate readily upon wetting; strong effervescence; moderately alkaline.

Depth to bedded siltstone ranges from 20 to 30 inches. The A horizon is commonly silt loam, but in some profiles is loam. It ranges from 2 to 7 inches in thickness. The B horizon ranges from 10 to 20 inches in thickness. The B2t horizon is silty clay loam or silty clay. The upper part ranges from dark brown to gray in hues of 10YR or 7.5YR. The underlying siltstone has strata that differ in degrees of hardness. Some strata are noncalcareous.

Huggins soils are mapped with Epping, Kadoka, and Wortman soils, and are generally near Imlay and Duroc soils. They have a darker colored A horizon and are deeper over siltstone than Epping and Imlay soils. They have a more clayey B horizon than Kadoka soils and are shallower over siltstone than Duroc soils. They have less sodium in the B horizon than Wortman soils and lack the A2 horizon that is typical of those soils.

Huggins silt loam, 2 to 5 percent slopes (HnB).—This soil is on uplands, mainly in the southwestern and south-central parts of the county. It has a profile similar to the one described as representative of the series, but in places its surface layer is slightly thicker.

Included with this soil in mapping are areas of Duroc, Epping, Kadoka, and Norrest soils. Duroc and Kadoka soils are on foot slopes and along drainageways. The Epping soil is on ridges, and the Norrest soil is on upper slopes. These inclusions generally make up less than 10 percent of a given mapped area.

This Huggins soil is medium in fertility. Available water capacity is low. Surface runoff is moderate. Controlling erosion and conserving moisture are the main concerns in management.

Many of the larger areas are cultivated. Winter wheat, sorghum, and alfalfa are the main crops. Other areas are in native grass and are used for grazing. Silty range site; capability unit IIIe–12; windbreak group 4.

Huggins silt loam, 5 to 9 percent slopes (HnC).—This soil is on uplands. Included in the areas mapped are tracts of Duroc, Epping, Kadoka, Norrest, Wanlee, and Wortman soils. Duroc, Kadoka, Wanblee, and Wortman soils are on foot slopes and along drainageways. Epping soils, the most extensive of the inclusions, are on the tops and upper sides of ridges. Norrest soils are near Epping soils. These inclusions generally make up less than 20 percent of a given mapped area. In the few areas where the proportion of inclusions is greater than this, Wanblee and Wortman soils alone make up 20 percent of the acreage.

This Huggins soil is medium in fertility. Available water capacity is low. Surface runoff is moderate. Controlling erosion and conserving moisture are the main concerns in management.

Most areas are in native grass and are used for grazing. Silty range site; capability unit IVe–3; windbreak group 4.

Huggins-Epping silt loams, 5 to 15 percent slopes (HpD).—This mapping unit is about 60 percent Huggins soil, about 30 percent Epping soil, and about 10 percent other soils. The Huggins soil is on the sides of ridges and entrenched drainageways. The Epping soil is on the higher parts of the landscape. It has a profile similar to the one described as representative of the series, but in places it contains more fine sand and less silt.

Included with these soils in mapping are spots of Conata, Duroc, Imlay, Keota, and Schamber soils. The Duroc soil is on foot slopes and along drainageways. The Conata soil is in scattered spots where the underlying material is shale or mudstone. Imlay and Keota soils are intermingled with the Epping soil. The Schamber soil is on a few ridgetops.

Huggins and Epping soils are too steep and too erodible for safe cultivation. Surface runoff is moderate to rapid, and available water capacity is low. All areas are in native grass and are used for grazing. Capability unit VIe–3; windbreak group 10; Huggins soil in Silty range site, Epping soil in Shallow range site.

Huggins-Kadoka silt loams, 0 to 2 percent slopes (HuA).—This mapping unit is about 60 percent Huggins soil, about 30 percent Kadoka soil, and 10 percent other soils. The Huggins soil is on very slight rises. It has a profile similar to the one described as representative of the series, but in places the surface layer is thicker. The Kadoka soil is in the lower, more level areas. It is described under the heading "Kadoka Series."

Included with these soils in mapping are small areas of Duroc and Kube soils. They are in swales and along drainageways.

These soils are medium in fertility. Surface runoff is slow. Available water capacity is low to medium. Conserving moisture is the main concern in management. Controlling soil blowing is a secondary concern in the larger areas.

Many of the large areas are cultivated. Winter wheat, sorghum, and alfalfa are the main crops. Other areas are in native grass and are used for grazing or hay. Silty range site; capability unit IIIs–5; Huggins soil in windbreak group 4, Kadoka soil in windbreak group 3.

Huggins-Kadoka silt loams, 2 to 5 percent slopes (HuB).—This mapping unit is about 65 percent Huggins soil, about 25 percent Kadoka soil, and 10 percent other soils. The Huggins soil has a profile similar to the one described as representative of the series, but in places its surface layer is slightly thicker. The Kadoka soil is on the lower parts of slopes. It has the profile described as representative of the Kadoka series. Included with these soils in mapping are small areas of Duroc and Kube soils in swales.

Surface runoff is moderate. Controlling erosion and conserving moisture are the main concerns in management.

Some of the larger areas are cultivated. Winter wheat, sorghum, and alfalfa are the main crops. Other areas are in native grass and are used for grazing or hay. Silty range site; capability unit IIIe–12; Huggins soil in windbreak group 4, Kadoka soil in windbreak group 3.

Huggins and Wortman silt loams, 2 to 5 percent slopes (HwB).—This mapping unit contains Huggins and Wortman soils in proportions that differ from one place to another. The Huggins soil is commonly dominant, but in some areas the proportion of the Wortman soil is large enough to affect management. The Huggins soil is on rises. The Wortman soil is in swales or low areas along drainageways and on the gently sloping tops of ridges and knolls. It is described under the heading "Wortman Series."

Included with these soils in mapping are areas of Duroc, Kube, and Wanblee soils. Duroc and Kube soils are in some of the swales and along drainageways. The Wanblee soil, the most extensive of the inclusions, is intermingled with the Wortman soil.

Huggins and Wortman soils have moderate surface runoff. The Wortman soil has very slow permeability. If it is cultivated, tilth deteriorates. Controlling erosion is the main concern in management. Improving tilth and water intake is an additional concern on the Wortman soil.

Many areas are in native grass and are used for grazing or hay. Alfalfa and winter wheat are the main crops in the few areas that are cultivated. Huggins soil in Silty range site, capability unit IIIe–12, windbreak group 4; Wortman soil in Claypan range site, capability unit IVs–3, windbreak group 9.

Imlay Series

The Imlay series consists of shallow, well-drained to excessively drained, gently sloping to steep, calcareous loamy soils on uplands. These soils formed in material weathered from the underlying siltstone or mudstone.

In a representative profile the surface layer is light brownish-gray light clay loam about 4 inches thick. The next 6 inches is gravelly clay loam that contains many fragments of siltstone. Between depths of 10 and 17 inches is brown siltstone that is loosely bedded and has clay loam in the cracks. Below a depth of 17 inches is pinkish-gray and brown siltstone.

Imlay soils are low in organic-matter content and fertility. Permeability is moderately slow to slow, and surface runoff is rapid. Available water capacity is very low.

All areas are in native grass and are used for grazing.

Representative profile of Imlay clay loam in an area of Imlay and Conata soils, 6 to 15 percent slopes, 2,080 feet west and 1,630 feet north of the southeast corner of sec. 18, T. 43 N., R. 31 W.:

A1—0 to 4 inches, light brownish-gray (10YR 6/2) light clay loam, dark grayish brown (10YR 4/2) moist; weak, fine, subangular blocky and granular structure; thin, weak crust in upper inch; soft, very friable; strong effervescence; moderately alkaline; clear, smooth boundary.

C1—4 to 10 inches, light-gray (2.5Y 7/2) shaly clay loam, grayish brown (2.5Y 5/2) moist; weak, coarse, prismatic structure parting to weak, fine, subangular blocky and durable plates and blocks of siltstone; hard, friable; about 60 percent fragments of brittle siltstone; strong effervescence; moderately alkaline; gradual, smooth boundary.

C2—10 to 17 inches, brown (7.5YR 5/2), loosely bedded siltstone and clay loam that has pale-brown streaks and coatings; soil fines between blocky and platy siltstone fragments; weak, coarse and very coarse, prismatic structure; hard, brittle fragments crumble readily when moist; few, medium and coarse, white masses of lime; strong effervescence; moderately alkaline; gradual boundary.

C3—17 to 26 inches, pinkish-gray (7.5YR 6/2) and brown (7.5YR 5/2) siltstone; bedded; very hard and brittle, but crumbles readily when wetted; faces of fractures coated with pale-brown dust and white masses of lime; common fine to coarse segregations of lime; slight effervescence; moderately alkaline.

Depth to siltstone or mudstone ranges from 8 to 20 inches. Fragments of siltstone occur throughout the soil and increase in number with increasing depth. The A horizon ranges from dark gray to light brownish gray in hues of 10YR or 2.5Y. It is loam, clay loam, or silt loam and ranges from 2 to 8 inches in thickness. The C1 horizon ranges from 2.5Y through 7.5YR in hue.

Imlay soils are mapped with Conata and Norrest soils. They are less clayey than Conata soils and are shallower over siltstone than Norrest soils. They are less silty and more clayey than Epping soils, which also are shallow over siltstone.

Imlay-Badland association (15 to 40 percent slopes) (Ib).—This mapping unit is 50 to 75 percent Imlay and other soils and 25 to 50 percent Badland. It is on escarpments and sides of drainageways. The Imlay soil is dominant in areas of vegetation. The Badland parts of the association are severely gullied.

Included in mapping are small areas of Conata, Epping, Keota, Larvie, Metre, Norrest, and Orella soils. Epping soils are on the higher parts of some of the vegetated areas. Keota and Norrest soils are below Epping and Imlay soils. Conata, Larvie, Metre, and Orella soils occur where the underlying shale or mudstone crops out in the lower part of the Badland areas. These inclusions make up as much as 25 percent of some mapped areas.

Surface runoff is rapid, and geologic erosion is active. This association is difficult to cross by vehicle, but most of the vegetated areas are accessible to livestock.

The Badland parts of the association lack a vegetative cover, but the rest is in native grass and is used for grazing. Imlay soil in Shallow range site, capability unit VIIs–1, windbreak group 10; Badland in capability unit VIIIs–2, range site and windbreak group not assigned.

Imlay and Conata soils, 6 to 15 percent slopes (IcD).—Some areas of this mapping unit are mainly Imlay soil, some are mainly Conata soil, and some contain both soils in proportions that differ from one place to another. The profile of the Imlay soil is the one described as representative of the series. The Conata soil is described under the heading "Conata Series."

Included with these soils in mapping are small areas of Cedar Butte, Haverson, Larvie, Norrest, Orella, and Samsil soils. The Cedar Butte soil is on foot slopes, and the Haverson soil is on narrow bottom land along drainageways. The Norrest soil is intermingled with the Imlay soil. Larvie, Orella, and Samsil soils are near the Conata soil. Most mapped areas contain eroding outcrops of siltstone or shale that lack vegetation and are similar to Barren badland. These inclusions make up 15 to 25 percent of a given mapped area.

Imlay and Conata soils are not suitable for cultivation. They are low in fertility and have very low available water capacity. Surface runoff is rapid, and the soils are erodible.

All areas are in native grass and are used for grazing. Shallow range site; capability unit VIs–2; windbreak group 10.

Imlay and Conata soils, 15 to 40 percent slopes (IcE).—Some areas of this mapping unit are dominantly Imlay soil, some are dominantly Conata soil, and some contain both soils in proportions that differ from one place to another. The Conata soil is described under the heading "Conata Series."

Included with these soils in most mapped areas are eroded outcrops of siltstone or shale on escarpments and sides of eroded drainageways. These outcrops are similar to Barren badland. Also included in mapping are areas of Cedar Butte, Dunday, Haverson, Larvie, Norrest, Orella, Schamber, Tuthill, and Valentine soils. Cedar Butte and Haverson soils are on foot slopes and along drainageways below the escarpments. Dunday, Tuthill, and Valentine soils are in areas mantled with sandy material. Larvie and Orella soils are near Conata soils, and Norrest soils are near Imlay soils. Schamber soils are on ridgetops above some of the escarpments. Inclusions make up as much as 30 percent of some mapped areas.

Imlay and Conata soils are not suitable for cultivation. They have very low available water capacity and are low in fertility. Surface runoff is rapid, and the soils are erodible.

All areas are in native grass and are used for grazing. Shallow range site; capability unit VIIs–1; windbreak group 10.

Imlay-Norrest silt loams, 9 to 25 percent slopes (InE).—This mapping unit is 50 to 60 percent Imlay soil, 30 to 40 percent Norrest soil, and 10 percent other soils (fig. 5). The Imlay soil is on narrow ridges and the steeper slopes. It has a profile similar to the one described as representative of the series, but the surface layer is silt loam. The Norrest soil is on some of the wider drainage divides and on the sides of ridges. It is generally less steep than the Imlay soil. It is described under the heading "Norrest Series."

Included with these soils in mapping are areas of Conata, Larvie, Okreek, and Schamber soils. Conata, Larvie, and Okreek soils are in parts of the areas underlain by shale or mudstone. The Schamber soil is on some of the ridges that are capped with gravel and sand. Also included in some areas are eroded outcrops of siltstone and shale similar to Barren badland.

Imlay and Norrest soils are erodible and are not suitable for cultivation. Surface runoff is moderate to rapid. Available water capacity is very low to low.

All areas are in native grass and are used for grazing. Capability unit VIIs–1; windbreak group 10; Imlay soil in Shallow range site, Norrest soil in Clayey range site.

Figure 5.—Imlay-Norrest silt loams, 9 to 25 percent slopes. The eroded area is an inclusion of Barren badland.

Kadoka Series

The Kadoka series consists of moderately deep, well-drained, nearly level to gently sloping silty soils on uplands. These soils formed in material weathered in place from the underlying siltstone or washed in from adjacent soils.

In a representative profile the surface layer is dark grayish-brown silt loam about 7 inches thick. The subsoil, about 18 inches thick, is silty clay loam that is dark gray in the upper part, brown in the middle part, and gray in the lower part. The underlying material is calcareous, pink silt loam to a depth of 31 inches. Below this is pinkish-gray and white siltstone and silt loam.

Kadoka soils are medium in organic-matter content and fertility. Permeability is moderate, and surface runoff is slow to moderate. Available water capacity is low to medium.

Many areas are in native grass and are used for grazing and hay. Wheat, sorghum, and alfalfa are the main crops.

Representative profile of Kadoka silt loam in an area of Huggins-Kadoka silt loams, 2 to 5 percent slopes, 2,610 feet west and 495 feet south of the northeast corner of sec. 4, T. 40 N., R. 32 W:

A1—0 to 3 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak, fine, subangular blocky and granular structure; slightly hard, friable; neutral; clear, smooth boundary.

A3—3 to 7 inches, dark grayish-brown (10YR 4/2) heavy silt loam, very dark brown (10YR 2/2) moist; weak, fine and medium, prismatic structure parting to weak, fine, subangular blocky and granular; slightly hard, friable; very thin, patchy clay films on prisms; neutral; clear, smooth boundary.

B21t—7 to 11 inches, dark-gray (7.5YR 4/1) silty clay loam, very dark brown (7.5YR 2/2) crushing to dark brown (7.5YR 3/2) moist; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky; very hard, firm; thin, continuous clay films; neutral; clear, smooth boundary.

B22t—11 to 18 inches, brown (7.5YR 5/3) silty clay loam, dark brown (7.5YR 4/3) moist; moderate, medium and coarse, prismatic structure parting to moderate, medium, blocky; very hard, firm; thin, continuous clay films; mildly alkaline; gradual, smooth boundary.

B3—18 to 25 inches, gray (7.5YR 5/1) silty clay loam, brown (7.5YR 5/2) moist; weak, medium and fine, prismatic structure parting to weak, medium, subangular blocky; hard, firm; thin, patchy clay films; common fine bits and particles of siltstone; mildly alkaline; gradual, smooth boundary.

C1ca—25 to 31 inches, pink (7.5YR 7/3) silt loam, brown (7.5YR 5/3) moist; weak, coarse, prismatic structure parting to weak, coarse, subangular blocky fragments; slightly hard, friable; common siltstone fragments; strong effervescence; moderately alkaline; gradual, smooth boundary.

C2—31 to 40 inches, pinkish-gray (7.5YR 7/2) and white (7.5YR 8/0), soft siltstone and silt loam, pinkish gray (7.5YR 6/2) moist; bedded; soft siltstone crushes to silt loam, but mass contains many fine fragments of more resistant siltstone; slight effervescence; moderately alkaline.

The depth to bedded, soft siltstone ranges from 20 to 40 inches. The A horizon is dark grayish brown or grayish brown and ranges from 3 to 7 inches in thickness. The B2t horizon ranges from 8 to 14 inches in thickness. The C horizon contains siltstone fragments that range from fine to coarse. The larger fragments are commonly coated with soft lime. The siltstone bedrock is soft and can be dug easily with a spade. It is noncalcareous in some areas.

Kadoka soils are mapped with Duroc, Huggins, and Kube soils and are near Blackpipe, Epping, Keota, and Wortman soils. They have a thinner A horizon than Duroc soils. They are deeper over siltstone than Epping soils and have a darker colored A horizon than Keota soils. They are less clayey in the B horizon than Blackpipe, Huggins, and Kube soils, and they contain less sodium than Wortman soils.

Kadoka-Kube silt loams (0 to 3 percent slopes) (Ka).—This mapping unit is 60 to 80 percent Kadoka soil and 20 to 40 percent Kube soil. It occurs as areas on stream terraces, upland flats, and long gentle slopes below steeper soils. The Kadoka soil is on slight rises. The Kube soil, which is in the more level areas, has the profile described as representative of the series.

Included with these soils in some of the mapped areas are Duroc, Huggins, Wanblee, and Wortman soils. Duroc, Wanblee, and Wortman soils are along drainageways. The Huggins soil is on rises adjacent to the Kadoka soil.

Kadoka and Kube soils have slow surface runoff. Available water capacity is low to medium in the Kadoka soil and medium to high in the Kube soil, depending on the depth to siltstone. Conserving moisture is the main concern in management.

Many of the larger tracts are cultivated. Winter wheat, alfalfa, and sorghum are the main crops. Narrow areas are in native grass and are used for grazing or hay. Silty range site; capability unit IIc-2; windbreak group 3.

Keota Series

The Keota series consists of moderately deep, well-drained, strongly sloping, calcareous silty soils on uplands. These soils formed in material weathered from the underlying siltstone.

In a representative profile the surface layer is light brownish-gray silt loam about 2 inches thick. Below this is a 9-inch transition layer of pale-brown silt loam that is slightly hard when dry and friable when moist. The underlying material to a depth of 20 inches is pinkish-gray and pink silt loam that contains fragments of siltstone. Below a depth of 20 inches is pinkish-gray, soft siltstone.

Keota soils are low in organic-matter content and fertility. Permeability is moderate, and surface runoff is moderate to rapid. Available water capacity is low.

All areas are in native grass and are used for grazing.

Representative profile of Keota silt loam in an area of Keota-Epping silt loams, 9 to 15 percent slopes, 850 feet east and 100 feet south of the northwest corner of sec. 20, T. 40 N., R. 31 W.:

A1—0 to 2 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak, very fine, platy structure and weak, fine, granular; soft, very friable; slight effervescence; mildly alkaline; abrupt, smooth boundary.

AC1—2 to 6 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak, medium, prismatic structure parting to weak, medium, subangular blocky; slightly hard, friable; strong effervescence; moderately alkaline; clear, smooth boundary.

AC2—6 to 11 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak, medium and coarse, prismatic structure parting to weak, medium and coarse, subangular blocky; slightly hard, friable; strong effervescence; moderately alkaline; clear, smooth boundary.

C1—11 to 13 inches, pinkish-gray (7.5YR 7/2) and pink (7.5YR 7/3) silt loam, brown (7.5YR 5/3) moist; weak to moderate, fine, granular structure; slightly hard, very friable; common fragments of siltstone and shards of volcanic glass; granules and siltstone fragments coated with soft lime; strong effervescence; moderately alkaline; abrupt, smooth boundary.

C2—13 to 20 inches, pinkish-gray (7.5YR 7/2) silt loam, brown (7.5YR 5/3) moist; weak, coarse and very coarse, prismatic structure parting to weak blocky fragments; hard, friable; few fine bits and particles of siltstone and shards of volcanic glass; strong effervescence; moderately alkaline; gradual, smooth boundary.

C3—20 to 36 inches, pinkish-gray (7.5YR 7/2), soft siltstone, brown (7.5YR 5/3) moist; bedded; soft, friable; siltstone crushes to silt loam, but the mass contains fragments of harder, more resistant siltstone and shards of volcanic glass; strong effervescence; moderately alkaline.

Depth to bedded, soft siltstone ranges from 20 to 40 inches. Few to many, fine and medium, angular and subrounded fragments of siltstone are throughout the profile. The A horizon ranges from dark grayish brown to light brownish gray in hue of 10YR. It is 2 to 6 inches thick. The AC horizon is intermediate in color between the A horizon and the pinkish-gray C horizon, in hues of 10YR and 7.5YR. It ranges from 4 to 15 inches in thickness.

Keota soils are mapped with Epping soils and are near Huggins and Kadoka soils. They are deeper over siltstone than Epping soils. They lack the B2t horizon that is typical of Huggins and Kadoka soils.

Keota-Epping silt loams, 9 to 15 percent slopes (KeD).—This mapping unit is about 50 percent Keota soil, about 40 percent Epping soil, and 10 percent other soils. It is commonly in long narrow areas on short sides of drainageways. The Keota soil is on the middle and lower parts. The Epping soil is on the higher parts and is described under the heading "Epping Series."

Included with these soils in mapping are areas of Duroc and Huggins soils. The Duroc soil is in narrow areas along drainageways. The Huggins soil is in some of the less sloping areas.

Keota and Epping soils are erodible and are not suitable for cultivation. Surface runoff is moderate to rapid. Fertility and available water capacity are low.

All areas are in native grass and are used for grazing. Capability unit VIe–3; windbreak group 10; Keota soil in Thin Upland range site, Epping soil in Shallow range site.

Keya Series

The Keya series consists of deep, moderately well drained, nearly level to gently sloping loamy soils on upland terraces. These soils formed in stream alluvium. In some areas part of the surface material washed in from adjacent soils.

In a representative profile the surface layer is dark-gray and dark grayish-brown loam about 16 inches thick. The subsoil, about 24 inches thick, is dark grayish-brown clay loam that is calcareous in the lower part. The underlying material is calcareous, pale-brown gravelly sand.

Keya soils are high in organic-matter content and fertility. Permeability is moderate, and available water capacity is medium to high. Surface runoff is slow. Some areas receive runoff from adjacent soils.

Many areas are under cultivation. Wheat, corn, sorghum, and alfalfa are the main crops. Other areas are in native grass and are used for grazing and hay.

The Keya soils in Mellette County are mapped only with Ree soils.

Representative profile of Keya loam in an area of Ree and Keya loams, 2 to 5 percent slopes, 1,320 feet south and 990 feet east of the northwest corner of sec. 19, T. 43 N., R. 27 W.:

A11—0 to 4 inches, dark-gray (10YR 4/1) loam, black (10YR 2/1) moist; weak, very fine, platy structure in upper 2 inches, and weak, fine, granular and subangular blocky in lower part; soft, friable; neutral; abrupt, smooth boundary.

A12—4 to 12 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak, medium and fine, prismatic structure parting to weak, medium, subangular blocky; hard, friable; prisms part more distinctly on horizontal plane than on vertical; many very fine pores; neutral; clear, smooth boundary.

A13—12 to 16 inches, dark grayish-brown (10YR 4/2) heavy loam, very dark brown (10YR 2/2) crushing to very dark grayish brown (10YR 3/2) moist; weak, medium and fine, prismatic structure parting to weak, medium, subangular blocky; hard, friable, slightly sticky; prisms part more distinctly on horizontal plane than on vertical; many very fine pores; mildly alkaline; clear, smooth boundary.

B21t—16 to 24 inches, dark grayish-brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) crushing to very dark grayish brown (10YR 3/2) moist; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky and blocky; extremely hard, very firm, sticky; thin, continuous clay films; mildly alkaline; gradual, smooth boundary.

B22t—24 to 34 inches, dark grayish-brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) crushing to very dark grayish brown (10YR 3/2) moist; moderate, fine and medium, prismatic structure parting to moderate, fine and medium, blocky; extremely hard, very firm, very sticky; thin, continuous clay films; mildly alkaline; gradual, smooth boundary.

B3ca—34 to 40 inches, dark grayish-brown (10YR 4/2) clay loam crushing to grayish brown (10YR 5/2), dark grayish brown (10YR 4/2) moist; weak, medium and coarse, prismatic structure parting to weak, medium, blocky; very hard, firm, very sticky; fine tongues from horizon above; common fine striations of lime; strong effervescence; moderately alkaline; gradual, smooth boundary.

IICca—40 to 60 inches, pale-brown (10YR 6/3) gravelly sand, brown (10YR 5/3) moist; single grained; loose; pebbles coated with lime and common fine masses of segregated lime; strong effervescence; moderately alkaline.

Horizons that have moist colors of very dark grayish brown or darker range from 20 to 40 inches in thickness. Depth to gravel and sand or gravelly sand ranges from 40 to 60 inches or more. The A horizon is loam or silt loam and ranges from 14 to 24 inches in thickness. The B2t horizon is clay loam or heavy loam and is more than 15 percent sand that is coarser than very fine sand. Some profiles have a C horizon of loam, clay loam, or sandy clay loam above the coarser textured IIC horizon. Segregations of lime, either in the B3ca horizon, the Cca horizon, or both, range from few to many.

Keya soils are mapped with Ree soils and frequently are near Lowry soils. They have a thicker A horizon than Ree soils and are less silty than Lowry soils. They are similar to Duroc and Woodly soils, but are less silty than Duroc soils and less sandy than Woodly soils.

Kolls Series

The Kolls series consists of deep, poorly drained, level clayey soils in depressions in the uplands. These soils formed in alluvium washed in from adjacent soils.

In a representative profile the surface layer is gray clay about 2 inches thick. The subsoil, about 16 inches thick, is gray clay that is extremely hard when dry and extremely firm when moist. It is calcareous in the lower part. The underlying material is calcareous, gray clay.

Kolls soils are medium in organic-matter content and fertility. Permeability is very slow. Surface run-in ponds and remains on the surface until it evaporates. The soil is dry seasonally. Available water capacity is low to medium.

All areas are in native grass and are used for hay or grazing.

Representative profile of Kolls clay in an area of Kolls and Hoven soils, 1,140 feet east and 180 feet south of the northwest corner of sec. 34, T. 42 N., R. 27 W.:

A1—0 to 2 inches, gray (2.5Y 6/1) clay, black (2.5Y 2/2) moist; weak, medium, subangular blocky structure parting to moderate, fine, granular; very hard, very firm, sticky; thin silty coats on faces of peds; mildly alkaline; abrupt, broken boundary.

B2g—2 to 8 inches, gray (2.5Y 6/0) clay, black (2.5Y 2/0) crushing to very dark gray (2.5Y 3/1) moist; weak, fine, prismatic structure parting to weak, medium, subangular blocky and weak, fine, blocky; extremely hard, extremely firm, very sticky and very plastic; mildly alkaline; clear, smooth boundary.

B3g—8 to 18 inches, gray (2.5Y 6/0) clay, black (2.5Y 2/0) crushing to very dark gray (2.5Y 3/1) moist; weak, medium and coarse, prismatic structure parting to weak, medium, blocky; extremely hard, extremely firm, very sticky and very plastic; slight effervescence; mildly alkaline; gradual, smooth boundary.

C1g—18 to 36 inches, gray (2.5Y 6/0) clay, very dark gray (2.5Y 3/0) crushing to dark gray (2.5Y 4/1) moist; weak, coarse, prismatic structure; extremely hard, extremely firm, very sticky and very plastic; slickensides along intersecting surfaces; strong effervescence; moderately alkaline; gradual, smooth boundary.

C2gcs—36 to 60 inches, gray (2.5Y 6/1) clay, very dark gray (5Y 3/1) crushing to dark gray (5Y 4/1) moist; massive; extremely hard, extremely firm, very sticky and very plastic; few to common fine and medium segregations of gypsum and other salts; slight effervescence; moderately alkaline.

When the soil is dry, cracks that are several feet long and ½ inch to 2 inches wide extend to depths of 36 inches or more. The A horizon is clay or silty clay and is commonly calcareous. It ranges from 1 to 5 inches in thickness. The B3 or C1 horizon in places contains a few fine segregations of lime. The lower part of the C horizon is commonly clay, but in some profiles is coarser textured, depending on the adjacent soils.

Kolls soils are mapped with Hoven soils. They are more calcareous and contain less sodium than the Hoven soils and lack the silty A horizon that is typical of those soils.

Kolls and Hoven soils (0 to 1 percent slopes) (Kh).—These soils are in closed depressions in the uplands. Some areas are Kolls soil, some are Hoven soils, and some contain both. Where these soils occur together, the Hoven soil is on the outer edge of the depressions.

These soils have poor tilth. Permeability is very slow, and surface run-in ponds and remains on the surface until it evaporates.

Most areas are in native grass and are used for grazing or hay. Closed Depression range site; capability unit VIs-1; windbreak group 10.

Kube Series

The Kube series consists of deep, well-drained, nearly level silty soils on uplands. These soils formed in material weathered from the underlying siltstone.

In a representative profile the surface layer is dark-gray silt loam about 6 inches thick. The subsoil, about 20 inches thick, is grayish-brown heavy silt loam in the upper part, grayish-brown silty clay loam in the middle part, and very pale brown silt loam in the lower part. The middle part is very hard when dry and friable when moist. The underlying material to a depth of 41 inches is calcareous, pink silt loam. Below this is calcareous, white and pinkish-gray, soft siltstone.

Kube soils are medium in organic-matter content and fertility. Permeability is moderate, and surface runoff is slow. Available water capacity is medium to high, depending on the depth to siltstone.

Many areas are under cultivation. Winter wheat, sorghum, and alfalfa are the main crops. Other areas are in native grass and are used for grazing and hay.

The Kube soils in Mellette County are mapped only with Kadoka soils.

Representative profile of Kube silt loam in an area of Kadoka-Kube silt loams, 900 feet east and 150 feet south of the northwest corner of sec. 23, T. 40 N., R. 33 W.:

Ap—0 to 6 inches, dark-gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; weak, fine, granular structure; slightly hard, very friable, slightly sticky; slightly acid; abrupt, smooth boundary.

B1—6 to 10 inches, grayish-brown (10YR 5/2) heavy silt loam, very dark grayish brown (10YR 3/2) moist; weak, medium, prismatic structure parting to weak, medium and fine, subangular blocky and granular; hard, friable, slightly sticky; slightly acid; clear, irregular boundary.

B2t—10 to 17 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) crushing to dark grayish brown (10YR 4/2) moist; weak, fine and medium, prismatic structure parting to moderate, fine and medium, subangular blocky; very hard, friable, slightly sticky; neutral; clear, wavy boundary.

B3—17 to 26 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak, fine and medium, subangular blocky structure; very hard, friable, slightly sticky; 5 percent or less very fine fragments of siltstone; neutral; clear, wavy boundary.

C1ca—26 to 41 inches, pink (7.5YR 8/4) silt loam, brown (7.5YR 5/4) moist; weak, fine and medium, subangular blocky structure; very hard, very friable; many very fine segregations of lime; strong effervescence; mildly alkaline; gradual, wavy boundary.

C2—41 to 60 inches, white (7.5YR 8/1) and pinkish-gray (7.5YR 7/2) soft siltstone, pinkish gray (7.5YR 7/2) moist; bedded; fragments crumble readily on wetting; strong effervescence; moderately alkaline.

Depth to bedded siltstone is commonly between 40 and 50 inches, but ranges to more than 60 inches. The A horizon ranges from very dark gray to gray or grayish brown in hue of 10YR and from 5 to 12 inches in thickness. The B horizon is 10YR or 7.5YR in hue and ranges from 14 to 26 inches in thickness. The B2t horizon is silty clay loam or silty clay. It has weak to moderate prismatic structure that parts to moderate or strong blocky structure.

Kube soils are mapped with Kadoka soils, are near Duroc, Huggins, and Wortman soils, and are similar to Blackpipe soils. They have a more clayey B horizon and are deeper over siltstone than Kadoka soils. They have a thinner A horizon than Duroc soils. They are deeper over siltstone than Blackpipe and Huggins soils. In contrast with Wortman soils, they do not have columnar structure and they contain less sodium.

Kyle Series

The Kyle series consists of deep, well-drained, gently sloping, calcareous clayey soils on foot slopes and fans on terraces. These soils formed in clayey material washed in from adjacent sloping soils.

In a representative profile the surface layer is gray clay about 2 inches thick. The subsoil, about 26 inches thick, is clay that is gray in the upper part, dark grayish brown in the middle part, and grayish brown in the lower part. Below a depth of 7 inches, it is extremely hard when dry and extremely firm when moist. The underlying material is dark-gray clay.

Kyle soils are moderately low in organic-matter content and medium in fertility. Permeability is very slow, and surface runoff is moderate. Available water capacity is low to medium.

Many areas are in native grass and are used for grazing or hay. A few areas are cultivated. Alfalfa, small grain, and sorghum are the main crops.

Representative profile of Kyle clay, 2,270 feet north and 105 feet east of the southwest corner of sec. 23, T. 44 N., R. 33 W.:

A1—0 to 2 inches, gray (2.5Y 5/1) clay, very dark grayish brown (2.5Y 3/2) crushing to dark grayish brown (2.5Y 4/2) moist; weak, fine, granular and subangular blocky structure; hard, firm, sticky; slight effervescence; mildly alkaline; abrupt, smooth boundary.

B21—2 to 7 inches, gray (2.5Y 5/1) clay, very dark grayish brown (2.5Y 3/2) crushing to dark grayish brown (2.5Y 4/2) moist; weak, medium, prismatic structure parting to weak, medium, subangular blocky and blocky; very hard, very firm, very sticky; strong effervescence; moderately alkaline; clear, smooth boundary.

B22—7 to 11 inches, dark grayish-brown (2.5Y 4/2), very dark grayish brown (2.5Y 3/2) crushing to dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure parting to moderate, medium and coarse, blocky; extremely hard, extremely firm, very sticky; common medium fragments of shale concretions; strong effervescence; moderately alkaline; clear, smooth boundary.

B3ca—11 to 28 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak, very coarse, prismatic structure parting to weak, medium and coarse, blocky; extremely hard, extremely firm, very sticky; many fine segregations of lime; strong effervescence; moderately alkaline; abrupt, smooth boundary.

C—28 to 60 inches, dark-gray (2.5Y 4/1) clay, dark grayish brown (2.5Y 4/2) moist; massive; extremely hard, very firm, sticky; thin, darker colored, buried layer at a depth of 44 inches; common to few fine segregations of gypsum and other salts; strong effervescence; moderately alkaline.

Thin layers or lenses that contain shale chips and fragments of shale concretions are commonly throughout the profile. The A horizon is gray or grayish brown in hues of 2.5Y or 10YR and ranges from 2 to 4 inches in thickness. It commonly has a thin, porous crust at the surface that is light gray or light brownish gray and is less than one-half inch thick. The B horizon ranges from gray to pale olive in hues of 2.5Y or 5Y and from 10 to 30 inches in thickness. The C horizon is commonly clay or silty clay, but in places it is as coarse as gravelly sandy loam or sandy clay loam. In a few areas, clay shale is between depths of 40 and 60 inches.

Kyle soils are lighter colored in the A horizon and upper part of the B horizon than Millboro and Promise soils, both of which also are deep clayey soils. They are deeper over shale than the nearby Lakoma, Opal, and Samsil soils.

Kyle clay (2 to 6 percent slopes) (Ky).—This soil is on terraces and fans in stream valleys. Included with this soil in mapping are small areas of Buffington soils.

Surface runoff is moderate, and many areas receive runoff from steeper adjacent soils. Permeability is very slow. Tilth rapidly deteriorates in cultivated areas. Controlling erosion is the main concern in management.

Most areas are in native grass and are used for grazing or hay. A few are cultivated. Alfalfa, sorghum, and small grain are the main crops. Clayey range site; capability unit IIIe–4; windbreak group 4.

Lakoma Series

The Lakoma series consists of moderately deep, well-drained, sloping to steep, calcareous clayey soils on uplands. These soils formed in material weathered from the underlying clayey shale.

In a representative profile the surface layer is dark grayish-brown clay about 3 inches thick. The subsoil, about 15 inches thick, is grayish-brown clay that is hard to very hard when dry and firm to very firm when moist. The lower part is faintly mottled with olive brown and dark gray. The underlying material to a depth of 24 inches is light olive-brown and gray clay that contains many shale fragments. Below this is multicolored clayey shale.

Lakoma soils are moderately low in organic-matter content and are low to medium in fertility. Permeability is slow, and surface runoff is moderate to rapid. Available water capacity is very low to low, depending on the depth to shale.

Representative profile of Lakoma clay in an area of Lakoma-Samsil clays, 5 to 15 percent slopes, 2,370 feet south and 720 feet west of the northwest corner of sec. 28, T. 42 N., R. 28 W.:

A1—0 to 3 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; weak, medium and fine, subangular blocky structure parting to moderate, medium and fine, granular; hard, friable, slightly sticky; slight effervescence; mildly alkaline; clear, smooth boundary.

B21—3 to 8 inches, grayish-brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) crushing to dark grayish brown (2.5Y 4/2) moist; weak, fine, prismatic structure parting to weak, medium, subangular blocky and fine granular; hard, firm, sticky; strong effervescence; moderately alkaline; clear, smooth boundary.

B22—8 to 11 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak, medium, prismatic structure parting to weak, medium, blocky; very hard, very firm, very sticky and plastic; thin, patchy, shiny faces on sides of peds; strong effervescence; moderately alkaline; gradual, smooth boundary.

B3—11 to 18 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; few, fine, faint mottles of dark gray and olive brown; weak, coarse, prismatic structure parting to weak, medium, blocky; hard, firm, slightly sticky and slightly plastic; few

fine segregations of lime in lower part; strong effervescence; moderately alkaline; gradual, smooth boundary.

C1ca—18 to 24 inches, light olive-brown (2.5Y 5/4 and 5/6) and gray (2.5Y 5/1) shaly clay, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure; hard, firm, slightly sticky; 30 percent partially weathered chips and fragments of shale; many coarse masses of segregated lime; strong effervescence; moderately alkaline; clear, wavy boundary.

C2—24 to 60 inches, mottled light olive-brown (2.5Y 5/4), light yellowish-brown (2.5Y 6/3), olive-brown (2.5Y 4/4), and dark-gray (2.5Y 4/0), soft shale; bedded; platy and conchoidal fracture planes; hard, but brittle when dry; seams of gypsum in upper part; plates in upper part coated with lime; mildly alkaline.

Depth to the underlying shale ranges from 20 to 40 inches. Few to many seams and masses of fine fragments of weathered shale commonly are throughout the profile. The A horizon is clay or silty clay and ranges from dark grayish brown to light yellowish brown in hues of 2.5Y or 10YR and from 2 to 5 inches in thickness. The B horizon ranges from grayish brown to light yellowish brown in hue of 2.5Y, and from 14 to 28 inches in thickness. When moist, the soil mass is firm to very firm, but crumbly. The B3 horizon and upper part of the C horizon contain very few to many segregations of lime.

Lakoma soils are mapped with Samsil soils and are near Kyle, Promise, and Opal soils. They are deeper over shale than Samsil soils and shallower over shale than Kyle and Promise soils. They have thinner horizons that have moist colors of very dark grayish brown or darker, and are somewhat less clayey than Opal soils.

Lakoma-Murdo complex, 9 to 15 percent slopes (LaD).—This mapping unit is about 60 percent Lakoma soil, about 25 percent Murdo soil, and 15 percent other soils. The Lakoma soil is on the sides of drainageways and ridges. It has a profile similar to the one described as representative of the series, but in places the surface layer is gravelly clay. The Murdo soil is on the upper sides and tops of ridges. It has the profile described as representative of the Murdo series.

Included with these soils in mapping are areas of Opal, Samsil, and Schamber soils. Opal and Samsil soils are adjacent to the Lakoma soil. The Schamber soil is on ridgetops adjacent to the Murdo soil.

Lakoma and Murdo soils are too erodible for cultivation. Surface runoff is moderate to rapid. Available water capacity is low.

All areas are in native grass and are used for grazing. Capability unit VIe–4; windbreak group 10; Lakoma soil in Clayey range site, Murdo soil in Shallow to Gravel range site.

Lakoma-Samsil clays, 5 to 15 percent slopes (LdD).—This mapping unit is 60 to 70 percent Lakoma soil, 20 to 30 percent Samsil soil, and 10 percent other soils. Slopes are long. The Lakoma soil is on the mid and lower parts of the landscape. It has the profile described as representative of the series. The Samsil soil is on the upper parts of ridges and knolls and on the sides of drainageways. It is described under the heading "Samsil Series."

Included with these soils in mapping are areas of Opal and Promise soils. Opal soils are on the mid and lower parts of the landscape, and Promise soils are in swales.

Lakoma and Samsil soils are too erodible for cultivation. Surface runoff is moderate to rapid, and permeability is slow. Available water capacity is low to very low. Controlling erosion is the main concern in management.

Most areas are in native grass and are used for grazing. Capability unit VIe–4; windbreak group 10; Lakoma soil in Clayey range site, Samsil soil in Shallow range site.

Lakoma-Samsil clays, 15 to 40 percent slopes (LdE).—This mapping unit is 50 to 70 percent Lakoma soil, 20 to 40 percent Samsil soil, and 10 percent other soils. The Lakoma soil is on the middle and lower slopes. The Samsil soil is on the steeper and higher parts of ridges and the sides of drainageways. It is described under the heading "Samsil Series."

Included with these soils in mapping are areas of Kyle, Opal, and Promise soils. Kyle and Promise soils are on foot slopes, in swales, and along drainageways.

Lakoma and Samsil soils are too erodible for cultivation. Surface runoff is rapid, and gullies form readily. Controlling erosion is the main concern in management. All areas are in native grass and are used for grazing. Capability unit VIIe–2; windbreak group 10; Lakoma soil in Clayey range site, Samsil soil in Shallow range site.

Larvie Series

The Larvie series consists of moderately deep, well-drained, nearly level to strongly sloping, calcareous clayey soils on uplands. These soils formed in material weathered from multicolored clayey shale and mudstone.

In a representative profile the surface layer is gray clay about 4 inches thick. The subsoil, about 13 inches thick, is gray and dark-gray clay that is extremely hard when dry and very firm when moist. The underlying material to a depth of 26 inches is reddish-gray clay. Below this is reddish-gray clayey shale or mudstone.

Larvie soils are moderately low in organic-matter content and are low to medium in fertility. Permeability is very slow, and surface runoff is slow to rapid. Available water capacity is very low to low, depending on the depth to shale.

Most areas are in native grass and are used for grazing and hay. Winter wheat, oats, and alfalfa are the main crops.

Representative profile of Larvie clay in an area of Larvie-Metre clays, 2 to 5 percent slopes, 1,840 feet north and 1,100 feet east of the southwest corner of sec. 18, T. 43 N., R. 31 W.:

A1—0 to 4 inches, gray (10YR 5/1) clay, dark grayish brown (10YR 4/2) moist; moderate, fine and medium, subangular blocky structure; weak crust on the surface; very hard, friable, slightly sticky; strong effervescence; mildly alkaline; clear, smooth boundary.

B2—4 to 12 inches, gray (10YR 5/1) and dark-gray (10YR 4/1) clay, dark grayish brown (10YR 4/2) moist; weak, medium, prismatic structure parting to moderate and weak, medium, blocky; extremely hard, very firm, very sticky and very plastic; prisms and blocks have shiny faces; strong effervescence; moderately alkaline; gradual, wavy boundary.

B3ca—12 to 17 inches, gray (10YR 6/1 and 5/1) clay, grayish brown (10YR 5/2) moist; weak, coarse, prismatic structure parting to weak, coarse, blocky; extremely hard, extremely firm, very sticky and plastic; dark-gray streaks extend into the horizon; faces of peds are shiny; few small slickensides; many medium seg-

regations of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

C1ca—17 to 26 inches, reddish-gray (10R 6/1) clay, weak red (10YR 4/2) moist; weak, coarse, prismatic structure parting to weak, fine and medium, irregular blocky; extremely hard, very firm, very sticky and very plastic; few slickensides; common pressure faces; many medium segregations of lime; strong effervescence; moderately alkaline; gradual, smooth boundary.

C2—26 to 36 inches, reddish-gray (10R 6/1), soft clayey shale or mudstone; bedded; breaks into irregular blocky fragments; very hard and brittle; few medium segregations of lime in upper 3 inches; strong effervescence; moderately alkaline.

Depth to shale or mudstone ranges from 20 to 40 inches. The A horizon ranges from dark gray to light brownish gray in hues of 10YR or 7.5YR, is clay or silty clay, and is 3 to 6 inches thick. The B horizon ranges from dark gray to weak red in hues of 10YR through 10R and from 10 to 20 inches in thickness. The C1ca and C2 horizons range from 7.5YR through 10R in hue.

Larvie soils are mapped with Conata, Hisle, and Metre soils and are near Cedar Butte, Okreek, Orella, and Norrest soils. They are deeper over siltstone, shale, or mudstone than Conata and Orella soils. They do not have the A2 horizon and the columnar structured B horizon that are typical of the Hisle and Cedar Butte soils. They have a lighter colored A horizon when moist than Metre and Okreek soils. They are more clayey than Norrest soils.

Larvie clay, 5 to 9 percent slopes (LeC).—This soil is on uplands. Included with it in mapping are small areas of Anselmo, Conata, Imlay, Metre, Norrest, Okreek, and Tuthill soils. Conata and Imlay soils are on some of the ridgetops. Metre and Okreek soils are in swales. Norrest soils are in areas where the underlying shale or siltstone is less clayey. Anselmo and Tuthill soils are in small areas where sandy material has been deposited over the underlying shale. Inclusions make up as much as 30 percent of a given mapped area.

This Larvie soil generally has poor tilth if it is cultivated. Surface runoff is moderate, and permeability is very slow. Controlling erosion is the main concern in management.

Most areas are in native grass and are used for grazing. Clayey range site; capability unit IVe–4; windbreak group 4.

Larvie-Conata clays, 6 to 15 percent slopes (LfC).—This mapping unit is about 60 percent Larvie soil, 20 to 30 percent Conata soil, and 10 to 20 percent other soils. The Larvie soil is typically less steep than the Conata soil. In some places its surface is uneven because small mounds or ridges rise 3 to 6 inches above the intervening low spots or troughs. The Conata soil is on ridges and knolls. It has the profile described as representative of the Conata series.

Included with these soils in mapping are areas of Blackpipe, Imlay, Metre, Norrest, Okreek, and Tuthill soils. Blackpipe, Metre, and Okreek soils are on foot slopes, in swales, and along drainageways. Imlay and Norrest soils are in places where the underlying material is siltstone. Tuthill soils are in places where sandy material has been deposited over the underlying shale.

Larvie and Conata soils are too erodible for cultivation. Surface runoff is moderate to rapid, and permeability is very slow.

All areas are in native grass and are used for grazing. Capability unit VIe–4; windbreak group 10; Larvie soil in Clayey range site, Conata soil in Shallow range site.

Larvie and Hisle soils, 0 to 9 percent slopes (LhC).—This mapping unit is mainly Larvie and Hisle soils, in proportions that differ from one area to another. The Larvie soil is generally on rises. The Hisle soil is in areas where the surface is uneven. It is described under the heading "Hisle Series."

Included with these soils in mapping are areas of Cedar Butte and Metre soils. Cedar Butte soils are near Hisle soils or along drainageways. Metre soils are near Larvie soils, and in some areas are nearly as extensive as those soils.

Hisle soils are not suitable for cultivation. Both Larvie and Hisle soils have slow to moderate surface runoff and very slow permeability. Both have poor tilth, especially Hisle soils.

Most areas are in native grass and are used for grazing. Vegetation is commonly sparse on the Hisle soil. Larvie soil in Clayey range site, capability unit IVe–4, windbreak group 4; Hisle soil in Thin Claypan range site, capability unit VIs–1, windbreak group 10.

Larvie-Metre clays, 2 to 5 percent slopes (LmB).—This mapping unit is about 50 percent Larvie soil, about 20 percent Metre soil, and 30 percent other soils. In places the surface is uneven because mounds or ridges rise 3 to 6 inches above the intervening low spots or troughs. Each soil mapped has the profile described as representative of its series.

Included with these soils in mapping are areas of Blackpipe, Norrest, and Okreek soils. Blackpipe and Norrest soils formed in less clayey material than Larvie and Metre soils. Okreek soils are on foot slopes and along drainageways.

Larvie and Metre soils have moderate surface runoff and very slow permeability. Tilth deteriorates readily in cultivated areas. Controlling erosion and improving tilth and water intake are concerns in management.

Most areas are in native grass and are used for grazing. A few are cultivated. Clayey range site; capability unit IIIe–4; windbreak group 4.

Lowry Series

The Lowry series consists of deep, well-drained, nearly level to gently sloping silty soils on high terraces and uplands. These soils formed in wind-deposited silty material.

In a representative profile the surface layer is grayish-brown silt loam about 5 inches thick. The subsoil, about 13 inches thick, is silt loam that is dark grayish brown in the upper part and grayish brown in the lower part. It is slightly hard to hard when dry and friable when moist. The underlying material is calcareous, light brownish-gray and light-gray silt loam.

Lowry soils are medium in organic-matter content and medium to low in fertility. Permeability is moderate, and surface runoff is slow to moderate. Available water capacity is high.

Many areas are in native grass and are used for grazing and hay. Wheat, sorghum, and alfalfa are the main crops.

Representative profile of Lowry silt loam, 0 to 2 percent slopes, 1,000 feet west and 1,000 feet north of the southeast corner of sec. 12, T. 43 N., R. 27 W.:

A11—0 to 1 inch, grayish-brown (2.5Y 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, very fine, platy structure parting to weak, fine, granular; slightly hard, friable; neutral; abrupt, smooth boundary.

A12—1 to 5 inches, grayish-brown (2.5Y 5/2) silt loam, very dark grayish brown (10YR 3/2 moist; weak, medium and fine, prismatic structure parting to weak, medium, subangular blocky and weak, fine, granular; slightly hard, friable; mildly alkaline; clear, smooth boundary.

B21—5 to 9 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, fine and medium, prismatic structure parting to weak, fine and medium, subangular blocky; slightly hard, friable; mildly alkaline; clear, smooth boundary.

B22—9 to 18 inches, grayish-brown (2.5Y 5/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak, medium, prismatic structure parting to weak, medium, blocky; hard, friable; slight effervescence; mildly alkaline; gradual, smooth boundary.

C1—18 to 28 inches, light brownish-gray (2.5Y 6/2) and light-gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; weak, medium, prismatic structure; hard, friable; many medium pores; strong effervescence; moderately alkaline; gradual, smooth boundary.

C2ca—28 to 38 inches, light-gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; weak, coarse, prismatic structure; slightly hard, friable; many fine open pores; many coarse segregations of lime; strong effervescence; moderately alkaline; gradual, smooth boundary.

C3—38 to 60 inches, light-gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, friable; few medium and fine segregations of lime; strong effervescence; moderately alkaline.

Depth to lime ranges from 8 to 20 inches. The A horizon is dark grayish brown or grayish brown in hues of 2.5Y or 10YR. It is commonly silt loam, but ranges from loam to silty clay loam in texture and from 4 to 12 inches in thickness. The B horizon is 2.5Y or 10YR in hue and ranges from 10 to 15 inches in thickness. The C horizon is commonly silt loam, but in a few areas it ranges from loam to silty clay loam, depending on the source of the wind-deposited material. In some profiles clay, shale, or siltstone is at a depth ranging from 40 to 60 inches.

Lowry soils have a more silty, less clayey B horizon than that of the nearby Ree and Savo soils. They have a darker colored A horizon and are deeper over lime than Keota and Mitchell soils, which are also friable silty soils.

Lowry silt loam, 0 to 2 percent slopes (LoA).—This soil is mostly on high terraces along the White River. It has the profile described as representative of the series.

Included with this soil in mapping are areas of Keya, Ree, and Savo soils. These soils are in places where the mantle of silty material is thin.

This Lowry soil has good tilth and takes in water readily. Surface runoff is slow, and available water capacity is high. Control of soil blowing is the main concern in management.

Many areas are in native grass and are used for grazing and hay. Winter wheat, sorghum, and alfalfa are the main crops. Silty range site; capability unit IIe–1; windbreak group 3.

Lowry silt loam, 2 to 5 percent slopes (LoB).—This soil is on uplands above Badland walls and on terraces near the White River.

Included with this soil in mapping are areas of Ree and Savo soils in places where the mantle of silty material is thin.

This Lowry soil has moderate surface runoff. Water erosion and soil blowing are hazards.

Most areas are in native grass and are used for grazing. Silty range site; capability unit IIe–1; windbreak group 3.

Lowry-Slickspots complex (0 to 3 percent slopes) (Ls).—This mapping unit is about 80 percent Lowry soil and about 20 percent Slickspots. Slickspots occur as small, scattered depressions throughout the mapped areas. They have a thin silty surface layer over a dense claypan subsoil.

Slickspots have very slow permeability. Surface runoff is slow, and water ponds on the surface. Tilth is poor in cultivated areas. Controlling soil blowing and improving tilth in the areas of Slickspots are the main concerns in management.

Most of the acreage is in native grass and is used for grazing. Vegetation is sparse in the Slickspots areas. Lowry soil in Silty range site, capability unit IIe–1, windbreak group 3; Slickspots in Thin Claypan range site, capability unit VIs–1, windbreak group 10.

Manter Series

The Manter series consists of deep, well-drained, undulating to hilly loamy soils on uplands. These soils formed in eolian sand.

In a representative profile the surface layer is dark-gray fine sandy loam about 3 inches thick. The subsoil, about 15 inches thick, is dark-brown fine sandy loam in the upper part and brown sandy loam in the lower part. It is hard when dry and friable when moist. The underlying material is light brownish-gray and light-gray loamy sand.

Manter soils are medium to moderately low in organic-matter content and are medium to low in fertility. Permeability is moderately rapid, and surface runoff is slow to moderate. Available water capacity is low to medium.

Most areas are in native grass and are used for grazing. Alfalfa is the main crop.

Representative profile of Manter fine sandy loam in an area of Manter-Tuthill fine sandy loams, 6 to 9 percent slopes, 1,005 feet west and 30 feet north of the southeast corner of sec. 21, T. 40 N., R. 30 W.:

A1—0 to 3 inches, dark-gray (10YR 4/1) fine sandy loam, very dark brown (10YR 2/2) moist; weak, fine, granular structure and weak, fine, subangular blocky; soft, very friable; neutral; abrupt, smooth boundary.

B21t—3 to 6 inches, dark-brown (7.5YR 4/2) fine sandy loam, very dark brown (7.5YR 2/2) moist; moderate, medium, prismatic structure parting to weak subangular blocky; hard, friable; thin, continuous clay films and bridging on faces of prisms; neutral; clear, smooth boundary.

B22t—6 to 10 inches, brown (7.5YR 5/2) sandy loam, dark brown (7.5R 4/2) moist; moderate, medium, prismatic structure parting to weak, coarse, subangular blocky; hard, friable; thin, continuous clay films and bridging on faces of prisms; neutral; clear, smooth boundary.

B3—10 to 18 inches, brown (7.5YR 5/3) sandy loam, dark brown (7.5YR 4/2) moist; weak, coarse, prismatic structure parting to weak, coarse and medium, subangular blocky; hard, friable; thin, patchy clay

films and bridging on faces of prisms; neutral; gradual, smooth boundary.

C1—18 to 36 inches, light brownish-gray (10YR 6/2) loamy sand, brown (10YR 5/3) moist; weak, coarse, prismatic structure; hard, very friable; mildly alkaline; gradual, smooth boundary.

C2—36 to 60 inches, light-gray (10YR 7/2) loamy sand, dark grayish brown (10YR 5/2) moist; single grained; slightly hard, very friable; mildly alkaline.

The A horizon ranges from dark gray to grayish brown or brown in hues of 7.5YR or 10YR and from 2 to 6 inches in thickness. The B horizon is 7.5YR or 10YR in hue and ranges from 10 to 20 inches in thickness. The B2t horizon ranges from moderate to weak in structure. The B3 horizon is sandy loam or loamy sand. The C horizon is loamy sand or sand. In places clayey material, shale, or siltstone is below a depth of 40 inches.

Manter soils are mapped with or are near Anselmo, Dunday, Tuthill, Whitelake, and Woodly soils. They have a more distinct increase in clay from the A horizon to the B horizon than Anselmo soils. They are less sandy than Dunday soils. They have a more sandy B horizon than Tuthill and Woodly soils. In contrast with Whitelake soils, they do not have an A2 horizon and they contain less sodium in the B horizon.

Manter-Anselmo fine sandy loams, 9 to 15 percent slopes (MaD).—This mapping unit is 50 to 60 percent Manter soil, 20 to 30 percent Anselmo soil, and about 20 percent other soils. Areas are rolling. The Anselmo soil is on the higher, steeper slopes, and the Manter soil is on the middle slopes. In many areas the two soils are intermingled. The Anselmo soil has the profile described as representative of its series.

Included with these soils in mapping are areas of Epping, Imlay, Larvie, Murdo, Norrest, and Tuthill soils. Tuthill soils, the most extensive of the included soils, are on foot slopes and on the longer, more stable slopes. Epping, Imlay, and Murdo soils are on some of the ridges and knolls. Larvie and Norrest soils are on the sides of ridges and knolls and in places have a thin mantle of sandy deposits.

Manter and Anselmo soils have moderate surface runoff. Water erosion and soil blowing are hazards. Slopes are too steep and irregular for cultivation.

All areas are in native grass and are used for grazing. Sandy range site; capability unit VIe–6; windbreak group 10.

Manter-Samsil complex, 9 to 25 percent slopes (McE).—This mapping unit is about 60 percent Manter soil, about 20 percent Samsil soil, and 20 percent other soils. Areas are rolling to hilly. The Manter soil formed in a thick mantle of wind-deposited sand over shale. The Samsil soil is shallow over shale. It is described under the heading "Samsil Series."

Included with these soils in mapping are areas of Caputa, Dunday, Lakoma, Tuthill, and Valentine soils. Caputa soils are in areas where the soil material is more loamy. Dunday and Valentine soils are in areas that have been eroded recently by wind. Lakoma soils are near Samsil soils.

Manter and Samsil soils have moderate to rapid surface runoff. Available water capacity is medium in the Manter soils, but is very low in the Samsil soils. Controlling water erosion and soil blowing are the main concerns in management.

All areas are in native grass and are used for grazing. Capability unit VIe–6; windbreak group 10; Manter soil in Sandy range site, Samsil soil in Shallow range site.

Manter-Tuthill fine sandy loams, 6 to 9 percent slopes (MfC).—This mapping unit is 50 percent Manter soil, 20 to 30 percent Tuthill soil, and 20 to 30 percent other soils. The Manter soil is on the sides and tops of ridges. The Tuthill soil is on the lower slopes. Each of these soils has the profile described as representative of its respective series.

Included with these soils in mapping are areas of Conata, Epping, Imlay, Larvie, Murdo, and Norrest soils. These inclusions are mostly on or near the crests of ridges where siltstone, shale, or gravelly material is at or near the surface.

Manter and Tuthill soils take in water readily and have medium available water capacity. Surface runoff is moderate. Controlling water erosion and soil blowing are the main concerns in management.

Most areas are in native grass and are used for grazing. Alfalfa is the main crop. Sandy range site; capability unit IVe–8; windbreak group 5.

Metre Series

The Metre series consists of moderately deep, well-drained, gently sloping clayey soils on uplands. These soils formed in material weathered from the underlying soft shale or mudstone.

In a representative profile the surface layer is gray clay about 4 inches thick. The subsoil, about 18 inches thick, is calcareous, gray clay in the upper part and calcareous, dark-gray and light-gray clay in the lower part. It is extremely hard when dry and extremely firm when moist. The underlying material to a depth of 30 inches is calcareous clay mottled with light gray, white, and grayish brown. Below this is calcareous, white and gray, soft mudstone.

Metre soils are medium in organic-matter content and fertility. Permeability is very slow, and surface runoff is moderate. Available water capacity is low to very low.

Most areas are in native grass and are used for grazing and hay. Winter wheat, oats, and alfalfa are the main crops.

In Mellette County Metre soils are mapped only with Larvie soils.

Representative profile of Metre clay in an area of Larvie-Metre clays, 2 to 5 percent slopes, 1,580 feet north and 1,200 feet east of the southwest corner of sec. 18, T. 43 N., R. 31 W.:

A1—0 to 4 inches, gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; weak, fragile, vesicular crust in upper inch and weak, fine and medium, subangular blocky and blocky structure below; very hard, very firm, slightly sticky and very plastic; mildly alkaline; abrupt, smooth boundary.

B21—4 to 10 inches, gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; weak, coarse, prismatic structure parting to weak, coarse, blocky; extremely hard, extremely firm, very sticky and very plastic; faces of peds are shiny; strong effervescence; moderately alkaline; clear, smooth boundary.

B22—10 to 17 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; weak, coarse and very coarse, prismatic structure parting to weak, coarse, blocky; extremely hard, extremely firm, very sticky and very plastic; faces of peds are shiny; few weak slickensides; few very fine segregations of lime; strong effervescence; moderately alkaline; gradual, smooth boundary.

B3ca—17 to 22 inches, mottled dark-gray (10YR 4/1) and light-gray (10YR 7/2) clay, dark gray (10YR 4/1) and light brownish gray (10YR 6/2) moist; weak, coarse, blocky structure; extremely hard, extremely firm, very sticky and very plastic; many medium and fine segregations of lime; strong effervescence; moderately alkaline; gradual, smooth boundary.

C1—22 to 30 inches, mottled light-gray (2.5Y 7/2), white (2.5Y 8/2), and grayish-brown (2.5Y 7/2), silty clay, light gray (2.5Y 7/2) and dark grayish brown (2.5Y 4/2) moist; weak, coarse, blocky structure parting to weak, very fine, blocky fragments; very hard, very firm, sticky and plastic; few black-colored seams and cracks one-fourth inch wide; few medium segregations of lime; strong effervescence; moderately alkaline; gradual, smooth boundary.

C2—30 to 60 inches, white (2.5Y 8/2) and gray (10YR 5/1), soft mudstone; bedded; strong effervescence; moderately alkaline.

Depth to mudstone ranges from 20 to 40 inches. The entire profile is commonly calcareous. The A horizon ranges from very dark gray to grayish brown in hues of 10YR or 2.5Y and from 3 to 6 inches in thickness. It is clay or silty clay. The B horizon has weak or moderate structure. It ranges from 12 to 20 inches in thickness. The B3ca and C1 horizons commonly are mottled with colors that range from 5Y through 5YR in hue.

Metre soils are mapped with Larvie soils and are near Conata, Okreek, Orella, and Norrest soils. They have darker color when moist than Larvie soils and are deeper over shale or mudstone than Conata and Orella soils. They do not have the contrast in clay content between the A and B horizons that is typical of Okreek soils. They are more clayey than Norrest soils.

Millboro Series

The Millboro series consists of deep, well-drained, gently sloping clayey soils on uplands. These soils formed in clayey material over shale.

In a representative profile the surface layer is dark-gray silty clay about 5 inches thick. The subsoil, about 35 inches thick, is grayish-brown clay that has tongues and streaks of dark gray and dark grayish brown in the upper part. It is very hard to extremely hard when dry and very firm to extremely firm when moist. Below a depth of 13 inches it is calcareous. The underlying material is calcareous, light brownish-gray clay.

Millboro soils are medium in organic-matter content and fertility. Permeability is slow, and surface runoff is moderate. Available water capacity is low to medium.

Many areas are cultivated. Wheat, corn, sorghum, and alfalfa are the main crops. Other areas are in native grass and are used for grazing and hay.

Representative profile of Millboro silty clay in an area of Millboro-Reliance complex, 2 to 5 percent slopes, 330 feet east and 330 feet south of the northwest corner of sec. 12, T. 40 N., R. 25 W.:

A1—0 to 5 inches, dark-gray (2.5Y 4/1) silty clay, very dark gray (2.5Y 3/1) crushing to very dark grayish brown (2.5Y 3/2) moist; fragile mulch in upper three-fourths inch; weak, fine, platy structure parting to weak, fine, granular below; soft, friable, sticky; neutral; abrupt, smooth boundary.

B21t—5 to 13 inches, grayish-brown (2.5Y 5/2) and dark-gray (2.5Y 4/1) clay, very dark grayish brown (2.5Y 3/2) and dark grayish brown (2.5Y 4/2) moist; weak, medium and fine, prismatic structure parting to moderate, medium, subangular blocky and blocky; very hard, very firm, very sticky and very plastic; faces of peds shiny in lower part; slight effervescence in few fine spots; neutral; clear, smooth boundary.

B22t—13 to 19 inches, grayish-brown (2.5Y 5/2) and dark grayish-brown (2.5Y 4/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate, medium, prismatic structure parting to moderate, medium, subangular blocky and blocky; extremely hard, extremely firm, very sticky and very plastic; faces of peds are shiny; slight effervescence; mildly alkaline; gradual, wavy boundary.

B23t—19 to 27 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate, coarse, prismatic structure parting to weak, coarse, blocky; extremely hard, extremely firm, very sticky and very plastic; faces of peds are shiny; few fine and medium slickensides and intersecting surface; slight effervescence; mildly alkaline; diffuse, smooth boundary.

B3ca—27 to 40 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) crushing to grayish brown (2.5Y 5/2) moist; weak, coarse and very coarse, prismatic structure parting to weak, coarse, blocky; extremely hard, extremely firm, very sticky and very plastic; patchy, shiny faces on prisms; common fine segregations of lime; strong effervescence; moderately alkaline; diffuse, smooth boundary.

C—40 to 60 inches, light brownish-gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; massive; very hard, very firm, very sticky and very plastic; slight effervescence; mildly alkaline.

The A horizon is clay or silty clay. It ranges from 3 to 6 inches in thickness and from dark gray to grayish brown in hues of 10YR or 2.5Y. The B2t horizon ranges from dark grayish brown to light brownish gray in hue of 2.5Y and from 20 to 30 inches in thickness. The C horizon is commonly clay or silty clay, but in places bedded shale is at a depth ranging from 40 to 60 inches.

Millboro soils are mapped with Reliance soils and are near Opal and promise soils. They are more clayey than Reliance soils. They have a more distinct increase in clay in the B horizon than Opal and Promise soils and are deeper over shale than Opal soils.

Millboro-Reliance complex, 2 to 5 percent slopes (MlB).—This mapping unit is 60 to 70 percent Millboro soil and 30 to 40 percent Reliance soil. In a few areas the Reliance soil is dominant. It is commonly on the crests of ridges and on south- and east-facing slopes that are thinly mantled with wind-deposited silty material. Slopes are long and smooth. Each of these soils has the profile described as representative of its respective series.

Included with these soils in mapping are areas of Lakoma, Opal, and Promise soils. Lakoma and Opal soils are on the upper sides and tops of some of the ridges. Promise soils are intermingled with Millboro soils.

Millboro and Reliance soils have moderate surface runoff. Available water capacity is medium to high. Permeability is slow in the Millboro soil and moderately slow in the Reliance soil. Controlling water erosion and soil blowing is the main concern in management.

Many of the larger areas are cultivated. Winter wheat, sorghum, corn, and alfalfa are the main crops. A few areas are in native grass and are used for grazing and hay. Capability unit IIIe–4; Millboro soil in Clayey range site, windbreak group 4; Reliance soil in Silty range site, windbreak group 3.

Millboro-Reliance complex, 5 to 9 percent slopes (MlC).—This mapping unit is 60 to 70 percent Millboro soil and 30 to 40 percent Reliance soil. The Reliance soil is commonly on south- and east-facing slopes or on rounded ridgetops. Each of these soils has a profile similar to the one described as representative of its respective series, but in places the surface layer is thinner.

Included with these soils in mapping are areas of Lakoma, Opal, and Promise soils. Lakoma and Opal soils are on the upper sides and tops of ridges. Promise soils are intermingled with Millboro soils.

Millboro and Reliance soils have moderate surface runoff. Water erosion is a serious hazard. Controlling water erosion and soil blowing is the main concern in management.

Winter wheat, spring-sown small grain, and alfalfa are the main crops. Many areas are in native grass and are used for grazing or hay. Capability unit IVe–4; Millboro soil in Clayey range site, windbreak group 4; Reliance soil in Silty range site, windbreak group 3.

Minatare Series

The Minatare series consists of deep, moderately well drained to somewhat poorly drained, nearly level to gently sloping silty soils that have a claypan subsoil. These soils are on terraces and fans in stream valleys and along drainageways on uplands. They formed in alluvium.

In a representative profile the surface layer is white silt loam about 1 inch thick. The subsoil, about 20 inches thick, is gray clay and silty clay loam in the upper part and calcareous, light brownish-gray silty clay loam in the lower part. The upper part is extremely hard when dry and very firm when moist. Many nests of salts extend from the lower part of the subsoil into the upper part of the underlying material. The underlying material to a depth of 42 inches is calcareous, light yellowish-brown clay loam. Below this is light-gray, stratified sand and clay.

Minatare soils are low in organic-matter content and fertility. Permeability is very slow, and surface runoff is slow. Available water capacity is low to medium.

Most areas are in native grass and are used for grazing.

Representative profile of Minatare silt loam in an area of Buffington-Minatare complex, 800 feet west and 130 feet north of the southeast corner of sec. 24, T. 42 N., R. 32 W.:

A2—0 to 1 inch, white (10YR 8/1) silt loam, dark gray (10YR 4/1) moist; weak, medium, platy structure parting to weak, fine, graular; slightly hard, very friable; medium acid; abrupt, smooth boundary.

B21t—1 to 3 inches, gray (10YR 6/1) clay, very dark gray (10YR 3/1) moist; moderate, medium, columnar structure; extremely hard, very firm, sticky and plastic; white (10YR 8/1) silt caps on tops of columns, dark gray (10YR 4/1) moist; neutral; clear, smooth boundary.

B22t—3 to 12 inches, gray (10YR 6/1 and 5/1) silty clay loam, dark gray (10YR 4/1) moist; weak, coarse, prismatic structure parting to moderate, medium, blocky; extremely hard, very firm, sticky and plastic; moderately alkaline; clear, wavy boundary.

B3saca—12 to 21 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; very hard, firm, sticky and slightly plastic; many fine nests of salts; many fine threads of segregated lime; strong effervescence;; strongly alkaline; gradual, wavy boundary.

C1saca—21 to 32 inches, light yellowish-brown (2.5Y 6/3) clay loam, grayish brown (2.5Y 5/2) moist; few, fine, distinct mottles of yellowish brown (10YR 5/6) moist; weak, medium and coarse, subangular blocky structure; very hard, friable, sticky; many, fine, faint nests of salts; many fine threads of segregated lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

C2—32 to 42 inches, light yellowish-brown (2.5Y 6/3) clay loam, light olive brown (2.5Y 5/3) moist; few, fine, distinct mottles of yellowish brown (10YR 5/6) moist; massive; hard, friable, sticky; many fine segregations of lime; strong effervescence; moderately alkaline; clear, wavy boundary.

C3—42 to 60 inches, light-gray (5Y 7/1), stratified sands and clays, light olive gray (5Y 6/2) and light gray (5Y 7/2) moist; many, fine, distinct mottles of yellowish brown (10YR 5/4) and gray (5Y 5/1) moist, and few, fine, distinct mottles of pale yellow (5Y 7/3) moist; massive; very hard, very friable; many medium segregations of lime; moderately alkaline.

Depth to carbonates ranges from 2 to 14 inches. The A horizon ranges from gray or grayish brown to white in hues of 10YR or 2.5Y. It is commonly silt loam, but ranges from fine sandy loam to silty clay loam. It is 1 to 4 inches thick. Some profiles have a thin A1 horizon about 1 inch thick. The B2t horizon is clay, silty clay, silty clay loam, or sandy clay and ranges from 5 to 12 inches in thickness. It is calcareous in places. The B3 and C1 horizons commonly contain few to many nests of salts. In places the lower part of the C horizon, below a depth of 40 inches, is clayey shale.

Minatare soils are mapped with or are near Buffington and Mosher soils. They have a profile similar to that of Cedar Butte, Hisle, and Wanblee soils. In contrast with Buffington soils, they have a thinner A horizon and have a columnar structured B horizon. They also have a thinner A horizon than Cedar Butte soils. They have a less clayey B horizon than Hisle soils, which are also moderately deep over clay shale. They are less silty than Wanblee soils, which are moderately deep over siltstone.

Minatare soils (0 to 6 percent slopes) (Mm).—This mapping unit is 50 to 80 percent Minatare soil and 20 to 50 percent other soils. Most areas are along drainageways on uplands and are less than 80 acres in size. Slopes are mostly less than 3 percent. The Minatare soils have a profile similar to the one described as representative of the series, but the surface layer ranges from loam to silty clay loam and in places is darker colored.

Included with these soils in mapping are areas of Hisle, Mosher, Opal, Promise, and Woodly soils. Hisle soils are in places where the depth to shale is less than 40 inches. Mosher soils are closely intermingled with Minatare soils. Opal and Promise soils are on rises. Woodly soils are adjacent to areas of sandy soils.

Minatare soils are not suitable for cultivation. Tilth is poor. Permeability is very slow, and available water capacity is low to medium. The dense claypan subsoil restricts root growth.

Most areas are in native grass and are used for grazing. Thin Claypan range site; capability unit VIs–1; windbreak group 10.

Mitchell Series

The Mitchell series consists of deep, well-drained, nearly level, calcareous silty soils on low terraces along streams. These soils formed in alluvium.

In a representative profile the surface layer is light-gray silt loam about 8 inches thick. Below this is a transition layer of light brownish-gray silt loam about 8 inches thick. It is slightly hard when dry and friable

when moist. The underlying material is light-gray silt loam to a depth of 28 inches. Below this it is light-gray, grayish-brown, and pale-brown very fine sandy loam.

Mitchell soils are low in organic-matter content and fertility. Permeability is moderate, and surface runoff is slow. Flooding normally is not a hazard, but ice jams, particularly on the White River, may cause some flooding in the spring. Available water capacity is high.

Wheat, corn, sorghum, and alfalfa are the main crops. Other areas are in native grass and are used for hay and grazing.

Representative profile of Mitchell silt loam, 2,250 feet west and 2,115 feet north of the southeast corner of sec. 25, T. 44 N., R. 28 W.:

A1—0 to 8 inches, light-gray (10YR 7/2) silt loam, dark grayish brown (10YR 4/2) moist; weak, medium, granular structure; slightly hard, friable; strong effervescence; moderately alkaline; clear, smooth boundary.

AC—8 to 16 inches, light brownish-gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; tongues of dark grayish brown (10YR 4/2, moist) extend through the horizon; weak, medium, prismatic structure parting to weak, medium, granular; slightly hard, friable; strongly effervescent; moderately alkaline; clear, smooth boundary.

C1—16 to 28 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; weak, coarse, prismatic structure; slightly hard, friable; violent effervescence; strongly alkaline; gradual, smooth boundary.

C2—28 to 40 inches, light-gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; violent effervescence; strongly alkaline.

C3—40 to 54 inches, grayish-brown (10YR 5/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; violent effervescence; strongly alkaline; gradual boundary.

C4—54 to 60 inches, pale-brown (10YR 6/5) very fine sandy loam, brown (10YR 5/3) moist; few, fine and medium, distinct mottles of brown; massive; soft, very friable; violent effervescence; strongly alkaline.

The A horizon ranges from grayish brown to light gray in hue of 10YR. It is commonly silt loam, but ranges from very fine sandy loam to silty clay loam. It ranges from 6 to 10 inches in thickness. The AC and C horizons are very fine sandy loam or silt loam having a clay content of less than 18 percent. The C horizon commonly contains dark-colored buried layers.

Mitchell soils are near Buffington, Glenberg, and Haverson soils. They have a lighter colored A horizon and are less clayey throughout the profile than Buffington soils. They are more silty than Glenberg soils. They are less clayey than Haverson soils and are generally better drained.

Mitchell silt loam (0 to 2 percent slopes) (Mn).—This soil is on low terraces mainly along the White and Little White Rivers. In places the surface layer is very fine sandy loam or silty clay loam.

Included with this soil in mapping are areas of Buffington and Glenberg soils. Buffington soils are in areas where the alluvium is more clayey, and Glenberg soils occur where it is more sandy.

This soil is low in organic-matter content and fertility and is high in lime. It is subject to soil blowing if cultivated. Controlling soil blowing is the main concern in management.

Most areas are in native grass and are used for grazing or hay. Alfalfa is the main crop. Thin Upland range site; capability unit IIIe–5; windbreak group 8.

Mosher Series

The Mosher series consists of deep, moderately well drained, nearly level to gently sloping silty soils that have a claypan subsoil. These soils formed in alluvium along drainageways of the uplands.

In a representative profile the surface layer is gray silt loam about 4 inches thick. The subsoil, about 17 inches thick, is gray clay. It is extremely hard when dry and extremely firm when moist. The lower part is calcareous. The underlying material is calcareous, grayish-brown silty clay.

Mosher soils are medium in organic-matter content and fertility. Permeability is very slow, and surface runoff is slow. Available water capacity is low to medium.

Most areas are in native grass and are used for grazing and hay.

Representative profile of Mosher silt loam in an area of Opal-Mosher complex, 2 to 6 percent slopes, 1,620 feet south and 360 feet east of the northwest corner of sec. 34, T. 43 N., R. 27 W.:

A1—0 to 2 inches, gray (10YR 5/1) silt loam, very dark brown (10YR 2/2) crushing to very dark grayish brown (10YR 3/2) moist; weak, fine, platy structure parting to weak, medium, granular; slightly hard, friable; neutral; abrupt, smooth boundary.

A2—2 to 4 inches, gray (10YR 6/1) silt loam, very dark grayish brown (10YR 3/2) moist; weak, fine, platy structure parting to weak, fine, granular; slightly hard, very friable; neutral; abrupt, wavy boundary.

B21t—4 to 6 inches, gray (10YR 5/1) clay, very dark brown (10YR 2/2) crushing to very dark grayish brown (10YR 3/2) moist; caps of columns coated with gray (10YR 6/1) silt loam; strong, fine, columnar structure parting to moderate, fine, blocky; extremely hard, extremely firm, very sticky and very plastic; thin, continuous clay films on faces of peds; neutral; abrupt, smooth boundary.

B22t—6 to 10 inches, gray (10YR 5/1) clay, very dark brown (10YR 2/2) crushing to very dark grayish brown (10YR 3/2) moist; moderate, fine and medium, prismatic structure parting to moderate, medium, blocky; extremely hard, extremely firm, very sticky and very plastic; thin, continuous clay films on faces of peds; slight effervescence; mildly alkaline; gradual, smooth boundary.

B3ca—10 to 21 inches, gray (10YR 5/1) clay, very dark grayish brown (10YR 3/2) moist; weak, coarse, prismatic structure parting to weak, medium and coarse, blocky; extremely hard, extremely firm, very sticky and very plastic; thin, patchy clay films; common medium segregations of lime; strong effervescence; moderately alkaline; gradual, smooth boundary.

C1casa—21 to 26 inches, grayish-brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure parting to weak, coarse, blocky; hard, firm; common fine segregations of salts; few fine segregations of lime; strong effervescence; moderately alkaline; gradual, smooth boundary.

C2sa—26 to 60 inches, grayish-brown (2.5Y 5/2) silty clay, light olive brown (2.5Y 5/3) moist; massive; hard, firm; common fine segregations of salts; strong effervescence; mildly alkaline.

The A horizon is commonly silt loam, but ranges from loam to silty clay loam. The A1 and A2 horizons combined are 4 to 8 inches thick. The B horizon ranges from 15 to 20 inches in thickness. The B3 horizon is moderately alkaline or strongly alkaline. The B3 horizon, the C1 horizon, or both, commonly contain few to many segregations of salts.

The C horizon is clay or silty clay, but in some profiles clay shale is at depths ranging from 40 to 60 inches.

Mosher soils are mapped with Opal and Promise soils and are near Minatare soils. Compared with Opal and Promise soils, they have a columnar structured B horizon and contain more sodium. They have a thicker A horizon than Minatare soils and contain salts at a greater depth.

Mosher soils (0 to 5 percent slopes) (Mo).—This mapping unit is 60 to 80 percent Mosher soils and 20 to 40 percent other soils. Areas are mostly along drainageways of the uplands. Each of these soils has a profile similar to the one described as representative of its respective series, but the surface layer ranges from loam to silty clay loam.

Included with these soils in mapping are areas of Buffington, Minatare, Opal, Promise, and Woodly soils. Buffington and Minatare soils are intermingled with Mosher soils. Opal and Promise soils are on rises. Woodly soils are in some of the areas that are adjacent to sandy soils.

Mosher soils have a dense claypan subsoil that restricts root growth. Permeability is very slow, and available water capacity is low. Tilth generally deteriorates in cultivated areas. Improving tilth and water intake is the main concern in management.

Most areas are in native grass and are used for grazing or hay. Claypan range site; capability unit IVs–2; windbreak group 9.

Murdo Series

The Murdo series consists of well-drained, gently sloping to strongly sloping loamy soils that are shallow over gravelly sand or sand and gravel. These soils formed in alluvium and are on uplands and the remnants of old terraces.

In a representative profile the surface is dark grayish-brown gravelly loam about 3 inches thick. The subsoil, about 12 inches thick, is dark grayish-brown and brown gravelly clay loam that is hard when dry and firm when moist. The underlying material is calcareous, brown gravelly sand to a depth of 24 inches. Below this is calcareous, brown sand and gravel.

Murdo soils are medium in organic-matter content and fertility. Permeability is moderately rapid to a depth of 15 inches and is rapid in the underlying sand and gravel. Surface runoff is moderate. Available water capacity is low.

Most areas are in native grass and are used for grazing.

Representative profile of Murdo gravelly loam in an area of Lakoma-Murdo complex, 9 to 15 percent slopes, 800 feet west and 720 feet south of the northeast corner of sec. 18, T. 42 N., 27 W.:

A1—0 to 3 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) moist; weak, fine, granular and subangular blocky structure; soft, friable; about 20 percent gravel; neutral; abrupt, smooth boundary.

B21t—3 to 10 inches, dark grayish-brown (10YR 4/2) gravelly clay loam, very dark brown (10YR 2/2) crushing to very dark grayish brown (10YR 3/2) moist; weak, medium, prismatic structure parting to moderate, fine, subangular blocky; hard, firm, sticky; thin, continuous clay films on all faces of peds; about 40 percent gravel; neutral; clear, smooth boundary.

B22t—10 to 15 inches, brown (7.5YR 5/2) gravelly loam, dark brown (7.5YR 4/2) moist; weak, medium, prismatic structure parting to weak, medium, subangular blocky; hard, firm, sticky; thin, patchy clay films; about 40 percent gravel; few pebbles encrusted with lime; neutral; gradual, smooth boundary.

IIC1ca—15 to 24 inches, brown (7.5YR 5/2) gravelly sand, dark brown (7.5YR 4/2) moist; single grained; loose; thick lime crusts on undersides of gravel; strong effervescence; mildly alkaline; gradual, wavy boundary.

IIC2—24 to 60 inches, brown (7.5YR 5/2) sand and gravel, dark brown (7.5YR 4/2) moist; single grained; loose; strong effervescence; mildly alkaline.

Depth to sand and gravel or gravelly sand ranges from 12 to 20 inches. The A horizon is dark grayish brown or grayish brown in hue of 10YR. It is loam or gravelly loam and is 2 to 4 inches thick. The B2t horizon is gravelly loam, gravelly clay loam, or very gravelly clay loam and is more than 35 percent gravel. It ranges from 10 to 20 inches in thickness. The IIC2 horizon is commonly stratified and crossbedded.

Murdo soils are shallower over sand and gravel than Altvan soils. They are deeper over sand and gravel than Schamber soils.

Murdo gravelly loam, 2 to 9 percent slopes (MrC).—This soil is mostly gently sloping to undulating, but is nearly level in a few places. It has a profile similar to the one described as representative of the series, but the surface layer is thicker in some nearly level areas.

Included with this soil in mapping are areas of Altvan, Manter, Schamber, Tuthill, and Valentine soils. Altvan soils are in areas where the depth to gravel is 20 to 40 inches. Manter, Tuthill, and Valentine soils are in areas that are mantled with wind-deposited sand. Schamber soils are on some of the ridgetops. Inclusions commonly make up about 20 percent of a given mapped area, but can be as much as 40 percent.

This Murdo soil is too droughty for cultivation. Permeability is moderately rapid as far down as the underlying material and is rapid in the sand and gravel.

Most areas are in native grass and are used for grazing. Shallow to Gravel range site; capability unit VIs–4; windbreak group 10.

Murdo-Lakoma complex, 6 to 15 percent slopes (MsD).—This mapping unit is 50 to 60 percent Murdo soil, about 20 to 30 percent Lakoma soil, and 20 percent other soils. Many areas are on the sides of gravelly ridges. The Murdo soil is on the upper slopes, and the Lakoma soil is on the lower slopes. The Lakoma soil has a profile similar to the one described as representative of its series, but in places the surface layer is gravelly clay.

Included with these soils in mapping are areas of Altvan, Caputa, Samsil, Schamber, Tuthill, and Woodly soils. Altvan soils are in places where the depth to gravel is 20 to 40 inches. Caputa and Tuthill soils are on slopes mantled with loamy material instead of sand and gravel. Samsil soils are on the shoulders of drainageways. Schamber soils are near the crests of ridges, adjacent to Murdo soils. Woodly soils are in some of the swales and in the bottom of drainageways or draws.

Murdo and Lakoma soils are too droughty and erodible for cultivation. All areas are in native grass and are used for grazing. Capability unit VIs–4; windbreak group 10; Murdo soil in Shallow to Gravel range site, Lakoma soil in Clayey range site.

Murdo-Schamber gravelly loams, 9 to 15 percent slopes (MuD).—This mapping unit is 50 to 70 percent

Murdo soil and 30 to 50 percent Schamber soil. It is commonly on gravelly ridges. Slopes are short and well rounded. The Murdo soil is on the sides of these ridges and the Schamber soil is on the upper sides and the ridgetops. The Schamber soil is described under the heading "Schamber Series."

Murdo and Schamber soils are too droughty and too erodible for cultivation. Available water capacity is low to very low. All areas are in native grass and are used for grazing. Capability unit VIs–4; windbreak group 10; Murdo soil in Shallow to Gravel range site, Schamber soil in Very Shallow range site.

Norrest Series

The Norrest series consists of moderately deep, well-drained, nearly level to strongly sloping, calcareous silty soils on uplands. These soils formed in material weathered from the underlying siltstone.

In a representative profile the surface layer is grayish-brown silt loam about 6 inches thick. The subsoil, about 26 inches thick, is heavy silty clay loam and clay loam that is light gray and grayish brown in the upper part and light brownish gray and light olive gray in the lower part. It is very hard to extremely hard when dry and firm to very firm when moist. Below the subsoil is light-gray, soft siltstone.

Norrest soils are moderately low in organic-matter content and medium in fertility. Permeability is moderately slow, and surface runoff is slow to moderate. Available water capacity is low to medium.

Most areas are in native grass and are used for grazing. Wheat, sorghum, and alfalfa are the main crops.

Representative profile of Norrest silt loam in an area of Norrest-Imlay silt loam, 5 to 9 slopes, 2,080 feet west and 1,600 feet north of the southeast corner of sec. 18, T. 43 N., R. 31 W.:

A1—0 to 6 inches, grayish-brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate, fine granular and subangular blocky structure; fragile crust in upper inch; hard, friable; many, very fine, hard particles of pale brown; violent effervescence; moderately alkaline; clear, smooth boundary.

B21t—6 to 18 inches, light-gray (10YR 7/1) and grayish-brown (10YR 5/2) heavy silty clay loam, gray (10YR 4/2) crushing to grayish brown (10YR 5/2) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; very hard, firm; few, fine, rounded siltstone fragments; thin, distinct, mostly continuous clay films that are coated in spots by lime; violent effervescence; moderately alkaline; gradual, smooth boundary.

B22t—18 to 26 inches, light-gray (5Y 7/1) and grayish-brown (10YR 5/2) clay loam, olive gray (5Y 5/2) and dark grayish brown (10YR 4/2) moist; strong, medium and coarse, prismatic structure parting to moderate, medium and coarse, blocky; extremely hard, very firm but crumbly; thin, distinct, continuous clay films; few fine siltstone fragments; common fine threads of segregated lime on faces and interior of peds; violent effervescence; moderately alkaline; gradual, smooth boundary.

B3ca—26 to 32 inches, light brownish-gray (10YR 6/2) and light olive-gray (5Y 6/2) clay loam, grayish brown (10YR 5/2) and olive (5Y 5/3, moist); moderate, medium and coarse, prismatic structure parting to weak, coarse, blocky; extremely hard, very friable; thin, distinct, continuous clay films on prism sides, patchy on blocks; common fine siltstone fragments; common white threads of segregated lime in masses and on faces of peds; violent effervescence; moderately alkaline; gradual, wavy boundary.

C—32 to 36 inches, light-gray (5Y 7/1), soft siltstone; bedded; hard and brittle, but crumbles readily on wetting; siltstone fragments stained with dark grayish brown; violent effervescence; moderately alkaline.

Depth to siltstone ranges from 20 to 40 inches. The A horizon ranges from dark grayish brown to light brownish gray in hue of 10YR. It is silt loam, silty clay loam, or clay loam and is 4 to 8 inches thick. In places it is noncalcareous in the upper part. The B2t horizon ranges from clay loam or silty clay loam to light clay. It averages between 35 to 45 percent clay. It ranges from 16 to 26 inches in thickness. A B3ca horizon of loam or clay loam occurs in some profiles.

Norrest soils are mapped with Blackpipe, Cedar Butte, Imlay, and Okreek soils and are near Huggins, Kube, and Larvie soils. In contrast with Blackpipe, Huggins, Kadoka, Kube, and Okreek soils they have thinner horizons that are very dark grayish brown or darker when moist. They have a more clayey B horizon than Kadoka soils. They are deeper over siltstone than Imlay soils. They are less clayey than Larvie soils.

Norrest silt loam, 5 to 9 percent slopes (NlC).—This soil is on uplands overlying siltstone.

Included in mapping are areas of Blackpipe, Larvie, Okreek, and Tuthill soils. Blackpipe soils are on foot slopes and in swales. Larvie and Okreek soils are in areas underlain by clayey mudstone or shale. Tuthill soils are in scattered areas that are mantled with loamy to sandy material. Inclusions commonly make up about 20 percent of a given mapped area, but in places they make up as much as 40 percent.

This Norrest soil is moderately low in organic-matter content and medium to low in fertility. Surface runoff is moderate. Permeability is moderately slow. Controlling erosion is the main concern in management.

Most areas are in native grass and are used for grazing. Clayey range site; capability unit IVe–3; windbreak group 4.

Norrest-Badland association (4 to 15 percent slopes) (Nm).—This mapping unit is 50 to 75 percent Norrest soil, about 20 percent Badland, and 5 to 30 percent other soils. Most areas are small, irregularly shaped sloping tables, or mesas, below the steeper, more rugged walls of Badland. These spots are isolated from each other by numerous eroding gullies that interlace the areas. The Norrest soil has a profile similar to the one described as representative of the series, but in places it is more than 40 inches deep over siltstone.

Included in mapping are areas of Blackpipe, Larvie, and Okreek soils. Blackpipe soils are adjacent to Norrest soils on some of the tables. Larvie and Okreek soils are in the more clayey areas.

This association has moderate to rapid surface runoff. Controlling erosion is the main concern in management. Most areas of the Norrest soil are too small, too irregularly shaped, or are inaccessible for cultivation.

All areas of the Norrest soil are in native grass and are used for grazing. The Badland parts are mostly barren. Norrest soil in Clayey range site, capability unit IVe–3, windbreak group 4; Badland in capability unit VIIIs–2, range site and windbreak group not assigned.

Norrest-Blackpipe silt loams, 0 to 2 percent slopes (NoA).—This mapping unit is about 60 percent Norrest soil, 20 to 30 percent Blackpipe soil, and 10 to 20 percent other soils. It is mostly in small, narrow areas along drainageways or small, nearly level drainage divides on

ridges. The Norrest soil is on slight rises and the Blackpipe soil is in swales. The Blackpipe soil is described under the heading "Blackpipe Series."

Included with these soils in mapping are areas of Duroc, Kube, Larvie, Okreek, Tuthill, and Woodly soils. Okreek soils, the most common of these, and Larvie soils are more clayey. Duroc soils are in swales. Kube soils are deep over siltstone. Tuthill and Woodly soils have loamy to sandy material over the underlying siltstone.

Norrest and Blackpipe soils have slow surface runoff. Available water capacity is low to medium, and the soils are somewhat droughty. The underlying siltstone restricts the development of roots. Conserving moisture is the main concern in management.

Many areas are in native grass and are used for grazing or hay. Winter wheat, sorghum, and alfalfa are the main crops. Capability unit IIIs–5; Norrest soil in Clayey range site, windbreak group 4; Blackpipe soil in Silty range site, windbreak group 3.

Norrest-Blackpipe silt loams, 2 to 5 percent slopes (NoB).—This mapping unit is about 65 percent Norrest soil, 15 to 25 percent Blackpipe soil, and 10 to 20 percent other soils. The Norrest soil is in the mid and upper parts of the landscape. The Blackpipe soil is on foot slopes and in swales. It has the profile described as representative of the series.

Included with these soils in mapping are areas of Kube, Larvie, Okreek, and Tuthill soils. Kube soils are in places that are deep over siltstone. Larvie and Okreek soils are in places underlain by shale or mudstone. Tuthill soils are on the higher parts of the landscapes in places that are mantled with loamy to sandy material.

Norrest and Blackpipe soils have moderate surface runoff. Controlling erosion is the main concern in management.

Many areas are in native grass and are used for grazing. Winter wheat, sorghum, and alfalfa are the main crops. Capability unit IIIe–12; Norrest soil in Clayey range site, windbreak group 4; Blackpipe soil in Silty range site, windbreak group 3.

Norrest-Cedar Butte silt loams, 3 to 9 percent slopes (NrC).—This mapping unit is 55 to 65 percent Norrest soil, 20 to 30 percent Cedar Butte soil, and 15 percent other soils. The Norrest soil is mostly sloping and is in the mid and upper parts of the landscape. The Cedar Butte soil is less sloping and is on foot slopes and along drainageways. It has the profile described as representative of the Cedar Butte series.

Included with these soils in mapping are areas of Blackpipe, Hisle, and Okreek soils. Okreek soils, the most extensive of these, are in areas that are underlain by shale or mudstone. Blackpipe soils are on some of the foot slopes. Hisle soils are along some of the drainageways.

Norrest and Cedar Butte soils have moderate surface runoff. Controlling erosion is the main concern in management. Most areas are in native grass and are used for grazing. Capability unit IVe–3; Norrest soil in Clayey range site, windbreak group 4; Cedar Butte soil in Claypan range site, windbreak group 9.

Norrest-Imlay silt loams, 5 to 9 percent slopes (NsC)—This mapping unit is about 70 percent Norrest soil and about 30 percent Imlay soil. The Norrest soil is in the middle and lower parts of the landscape. It has the profile described as representative of the series. The Imlay soil is on the tops and upper sides of ridges. It has a profile similar to the one described as representative of the Imlay series, but the surface layer is silt loam.

Included with these soils in mapping are areas of Conata, Epping, Larvie, and Okreek soils. Conata and Epping soils are on some of the tops of ridges, and Larvie and Okreek soils are on some of the sides.

Norrest and Imlay soils have moderate surface runoff. Available water capacity is very low in the shallow Imlay soil. Controlling erosion is the main concern in management.

Most areas are in native grass and are used for grazing. Norrest soil in Clayey range site, capability unit IVe–3, windbreak group 4; Imlay soil in Shallow range site, capability unit VIs–2, windbreak group 10.

Norrest-Imlay silt loams, 9 to 15 percent slopes (NsD).—This mapping unit is about 65 percent Norrest soil and 35 percent Imlay soil. The Norrest soil is on the middle and lower parts of the landscape, and the Imlay soil is on the upper sides and tops of ridges. The Imlay soil has a profile similar to the one described as representative of its series, but the surface layer is silt loam.

Included with these soils in mapping are areas of Conata, Epping, Larvie, and Okreek soils. Epping soils are on some of the ridges. Conata, Larvie, and Okreek soils are in places that are underlain by shale or mudstone.

Norrest and Imlay soils are too erodible for cultivation. Surface runoff is moderate to rapid. The Imlay soil has very low available water capacity.

All areas are in native grass and are used for grazing. Capability unit VIe–3; windbreak group 10; Norrest soil in Clayey range site, Imlay soil in Shallow range site.

Norrest and Okreek soils, 2 to 5 percent slopes (NtB).—These soils occur in proportions that differ from one area to another, depending on differences in the underlying bedrock material. The profile of the Norrest soil is similar to the one described as representative of its series, but in a few areas the surface layer is fine sandy loam. The profile of the Okreek soil is the one described as representative of its series.

Included with these soils in mapping are areas of Huggins and Larvie soils. Huggins soils are in some areas of Norrest soils. Larvie soils commonly are intermingled with Okreek soils.

Norrest and Okreek soils have moderate surface runoff. Available water capacity is low, and these soils are somewhat droughty. Controlling erosion is the main concern in management.

Most areas are in native grass and are used for grazing. Clayey range site; capability unit IIIe–12; windbreak group 4.

Okreek Series

The Okreek series consists of moderately deep, well-drained, gently sloping clayey soils on uplands. These soils formed in material weathered from the underlying clay-rich siltstone.

In a representative profile the surface layer is gray and grayish-brown silty clay about 7 inches thick. The

subsoil, about 18 inches thick, is grayish-brown and light brownish-gray clay. The upper part is extremely hard when dry and extremely firm when moist. The lower part is calcareous. The underlying material is calcareous, light brownish-gray silty clay to a depth of 30 inches. Below this is soft siltstone.

Okreek soils are medium in organic-matter content and fertility. Permeability is slow, and surface runoff is moderate. Available water capacity is low to very low.

Most areas are in native grass and are used for grazing or hay. Wheat and alfalfa are the main crops.

The Okreek soils in Mellette County are mapped only with Norrest soils.

Representative profile of Okreek silty clay in an area of Norrest and Okreek soils, 2 to 5 percent slopes, 2,400 feet west and 300 feet north of the southeast corner of sec. 20, T. 40 N., R. 29 W.:

A11—0 to 2 inches, gray (10YR 5/1) silty clay, very dark gray (10YR 3/1) moist; weak, medium, subangular blocky structure parting to weak, fine, granular; hard, firm, sticky; neutral; abrupt, smooth boundary.

A12—2 to 7 inches, grayish-brown (10YR 5/2) silty clay, very dark gray (10YR 3/1) moist; weak, fine, prismatic structure parting to moderate, medium, subangular blocky and weak, fine, granular; very hard, very firm, very sticky; thin, patchy clay films on faces of prisms and blocks; neutral; clear, smooth boundary.

B2t—7 to 16 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; peds coated with very dark grayish brown (10YR 3/2) moist; moderate, medium, prismatic structure parting to weak and moderate, medium, blocky and subangular blocky; extremely hard, extremely firm, very sticky and very plastic; thin, continuous clay films; neutral; gradual, smooth boundary.

B3—16 to 25 inches, light brownish-gray (2.5Y 6/2) and grayish-brown (2.5Y 5/2) clay, grayish brown (2.5Y 5/2) and dark grayish brown (2.5Y 4/2) moist; moderate, medium and coarse, prismatic structure parting to moderate, medium, blocky; extremely hard, very firm, very sticky and very plastic; thin, patchy clay films; strong effervescence; moderately alkaline; gradual, smooth boundary.

C1—25 to 30 inches, light brownish-gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) and gray (2.5Y 5/1) moist; weak, coarse, prismatic structure; extremely hard, firm; thin, very patchy clay films; common bits and fragments of siltstone; strong effervescence; moderately alkaline; clear, wavy boundary.

C2—30 to 40 inches, light-gray (5Y 7/2) siltstone, light olive gray (5Y 6/2) and gray (5Y 5/1) moist; bedded; extremely hard, but brittle, crumbles easily when wetted; strong effervescence; moderately alkaline.

Depth to soft siltstone or shale ranges from 20 to 40 inches. The A horizon is silty clay or silty clay loam and ranges from 3 to 8 inches in thickness. The B2t horizon is clay or silty clay and ranges from 9 to 21 inches in thickness. The B3 and C1 horizons in some profiles contain few to common segregations of lime. The C2 horizon is soft, clay-rich siltstone or shale.

Okreek soils are mapped with Norrest soils and are more clayey than those soils. They have a more distinct increase of clay in the B horizon than Opal soils, which also are clayey and moderately deep over shale.

Opal Series

The Opal series consists of moderately deep, well-drained, nearly level to strongly sloping clayey soils on uplands. These soils formed in material weathered from the underlying soft clay shale.

In a representative profile the surface layer is about 3 inches thick. It is dark-gray silty clay in the upper part and gray clay in the lower part. The subsoil, about 27 inches thick, is gray and grayish-brown clay. It is extremely hard when dry and extremely firm when moist. The underlying material to a depth of 34 inches is calcareous, grayish-brown clay. Below this is dark grayish-brown and olive-brown shale.

Opal soils are medium in organic-matter content and fertility. Permeability is very slow, and surface runoff is slow to moderate. Available water capacity is low to very low.

Many areas are in native grass and are used for grazing and hay. Wheat, alfalfa, and sorghum are the main crops.

Representative profile of Opal clay, mounded, 5 to 9 percent slopes, 2,520 feet south and 1,090 feet west of the northeast corner of sec. 28, T. 42 N., R. 28 W.:

A11—0 to 1 inch, dark-gray (2.5Y 4/1) silty clay, very dark grayish brown (2.5Y 3/2) moist; weak, medium, subangular blocky and granular structure; weak, fragile crust or mulch on the surface; hard, firm, sticky; slight effervescence; mildly alkaline; abrupt, broken boundary.

A12—1 to 3 inches, gray (2.5Y 5/1) clay, very dark grayish brown (2.5Y 3/2) moist; weak, medium and fine, prismatic structure parting to weak, medium, subangular blocky and weak, fine, granular; very hard, very firm, very sticky and very plastic; slight effervescence; mildly alkaline; clear, smooth boundary.

B21—3 to 8 inches, gray (2.5Y 5/1) clay, very dark grayish brown (2.5Y 3/2) moist; weak, medium and coarse, prismatic structure parting to weak, fine and medium, blocky and subangular blocky; extremely hard, extremely firm, very sticky and very plastic; shiny pressure faces on peds; slight effervescence; mildly alkaline; clear, smooth boundary.

B22—8 to 18 inches, gray (2.5Y 5/1) clay, very dark grayish brown (2.5Y 3/2) crushing to dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure parting to weak, fine and medium, blocky; extremely hard, extremely firm, very plastic; shiny pressure faces on peds; slight effervescence; mildly alkaline; gradual, smooth boundary.

B23—18 to 26 inches, gray (2.5Y 5/1) clay, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure parting to weak, coarse, blocky; extremely hard, extremely firm, very sticky and very plastic; shiny pressure faces on peds; slight effervescence; mildly alkaline; gradual, smooth boundary.

B3ca—26 to 30 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure parting to weak, coarse, blocky; extremely hard, extremely firm, very sticky and very plastic; patchy, shiny faces on peds; common medium segregations of lime; strong effervescence; moderately alkaline; clear, wavy boundary.

C1ca—30 to 34 inches, grayish-brown (2.5Y 5/2) and light-gray (5Y 7/2) clay, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure; very hard, very firm, sticky and plastic; patchy, shiny faces on prisms; common fine chips and fragments of weathered shale; common medium segregations of lime and gypsum; strong effervescence; moderately alkaline; gradual, wavy boundary.

C2—34 to 40 inches, dark grayish-brown (2.5Y 4/2) and olive-brown (2.5Y 4/4), soft shale; bedded, platy; coatings of lime on plates and seams of gypsum crystals; mildly alkaline.

Depth to bedded shale ranges from 20 to 40 inches. Cracks as much as 1 inch wide and several feet long extend downward through the soil if it is dry. The A horizon ranges from dark gray to grayish brown or olive gray in hues of 10YR through 5Y. It is clay or silty clay and is 3 to 6 inches

thick. In some profiles it is noncalcareous. The B horizon is 2.5Y or 5Y in hue and ranges from 12 to 30 inches in thickness.

Opal soils are mapped with Mosher and Promise soils and are near Kyle, Lakoma, Millboro, and Samsil soils. They do not have the columnar structure that is typical of Mosher soils and contain less sodium than those soils. They are shallower over shale than Kyle, Millboro, and Promise soils. Compared with Lakoma soils, they have thicker upper horizons that are very dark grayish brown or darker when moist. They are deeper over shale than Samsil soils. They do not have the distinct increase of clay in the B horizon that is typical of Okreek soils.

Opal clay, 5 to 9 percent slopes (OcC).—This soil is on upland ridges. Included with it in mapping are small amounts of Promise soils in swales and on the lower sides of the ridges.

This Opal soil has moderate surface runoff. Permeability is very slow. Tilth generally deteriorates if this soil is cultivated. Controlling erosion is the main concern in management.

Most areas are in native grass and are used for grazing. Clayey range site: capability unit IVe–4; windbreak group 4.

Opal clay, mounded, 5 to 9 percent slopes (OgC).—The surface of this soil is uneven because small ridges and troughs extend up and down the slopes. The ridges, about 2 feet wide, rise a few inches above the troughs and are spaced at relatively uniform intervals. This soil has the profile described as representative of the series, but the surface layer on the small ridges is lighter colored. Included with this soil in mapping are a few areas of Promise soils on the lower parts of the landscape.

This Opal soil has moderate surface runoff. Permeability is very slow. Tilth generally deteriorates in cultivated areas. Controlling erosion is the main concern in management.

Most areas are in native grass and are used for grazing. Clayey range site; capability unit IVe–4; windbreak group 4.

Opal-Caputa complex, 2 to 5 percent slopes (OlB).—This mapping unit is 60 to 80 percent Opal soil and 20 to 40 percent Caputa soil. The Caputa soil is in places that have loamy deposits over the underlying shale. Each of these soils has a profile similar to the one described as representative of its respective series, but in places the surface layer is slightly thicker.

Opal and Caputa soils have moderate surface runoff. Permeability ranges from moderately slow in the Caputa soil to very slow in the Opal soil. Available water capacity ranges from very low in the Opal soil to high in the Caputa soil. Controlling water erosion and soil blowing is the main concern in management.

Most areas are in native grass and are used for grazing. Winter wheat, alfalfa, and sorghum are the main crops. Capability unit IIIe–4; Opal soil in Clayey range site, windbreak group 4; Caputa soil in Silty range site, windbreak group 3.

Opal-Caputa complex, 5 to 9 percent slopes (OlC).—This mapping unit is 65 to 80 percent Opal soil and 20 to 35 percent Caputa soil. The Caputa soil is commonly on the higher parts of the landscape. It is described under the heading "Caputa Series."

Opal and Caputa soils have moderate surface runoff. Controlling erosion and soil blowing is the main concern in management.

Most areas are in native grass and are used for grazing. Capability unit IVe–4; Opal soil in Clayey range site, windbreak group 4; Caputa soil in Silty range site, windbreak group 3.

Opal-Mosher complex, 2 to 6 percent slopes (OmB).—This mapping unit is 80 percent Opal soil and 20 percent Mosher soil. The Opal soil is on rises. The Mosher soil is along drainageways. It has the profile described as representative of the Mosher series.

Included with these soils in mapping are areas of Caputa, Minatare, and Promise soils. Minatare soils, the most common, are intermingled with Mosher soils and in places are more extensive than those soils. Caputa soils are on the crests of rounded ridges and knolls. Promise soils are on foot slopes and along drainageways.

Opal and Mosher soils have moderate surface runoff. Tilth generally deteriorates in cultivated areas. The dense claypan subsoil of the Mosher soil restricts root growth. Controlling erosion is the main concern in management.

Most areas are in native grass and are used for grazing or hay. Capability unit IIIe–4; Opal soil in Clayey range site, windbreak group 4; Mosher soil in Claypan range site, windbreak group 9.

Opal-Promise clays, 2 to 5 percent slopes (OpB).—This mapping unit is 60 to 80 percent Opal soil and 20 to 40 percent Promise soil. A few areas are entirely Opal soil. The Opal soil is on the sides and tops of ridges. The Promise soil is on foot slopes and along drainageways. It is described under the heading "Promise Series."

Opal and Promise soils have moderate surface runoff. Tilth generally deteriorates in cultivated areas. Controlling erosion and soil blowing is the main concern in management.

Winter wheat, alfalfa, sorghum, and corn are the main crops in cultivated areas. Other areas are in native grass and are used for grazing and hay. Clayey range site; capability unit IIIe–4; windbreak group 4.

Opal-Tuthill complex, 2 to 5 percent slopes (OtB).—This mapping unit is 60 to 80 percent Opal soil and 20 to 40 percent Tuthill soil. The Opal soil is on the mid and lower parts of the landscape. It has a profile similar to the one described as representative of its series, but in places the surface layer ranges from fine sandy loam to clay loam. The Tuthill soil is on the crests of rises. It has a profile similar to the one described as representative of the Tuthill series, but in places the surface layer is loam and the material below a depth of 40 inches is clay or shale.

Included with these soils in mapping are areas of Promise and Woodly soils. They are on foot slopes and in swales.

Opal and Tuthill soils have moderate surface runoff. The Tuthill soil is easy to cultivate, takes in water readily, and has medium available water capacity. In contrast, the Opal soil has very slow permeability and low to very low available water capacity. Controlling water erosion and soil blowing is the main concern in management.

Winter wheat, alfalfa, sorghum, and corn are the main crops in cultivated areas. Other areas are in native grass

and are used for grazing and hay. Capability unit IIIe–4; Opal soil in Clayey range site, windbreak group 4; Tuthill soil in Sandy range site, windbreak group 5.

Opal-Tuthill complex, 5 to 15 percent slopes (OtD).—This mapping unit is 60 to 70 percent Opal soil, 20 to 30 percent Tuthill soil, and 10 percent other soils. The Opal soil is on the sides of the ridges. It has a profile similar to the one described as representative of its series, but in places near the Tuthill soil the surface layer ranges from fine sandy loam to clay loam. The Tuthill soil is mainly on the tops and upper sides of the ridges. It has a profile similar to the profile described as representative of its series, but in places the surface layer is loam and the material below a depth of 40 inches is clay or shale.

Included with these soils in mapping are areas of Caputa, Promise, and Woodly soils. Caputa soils are adjacent to Tuthill soils. Promise and Woodly soils are on foot slopes and along drainageways.

Opal and Tuthill soils have moderate surface runoff. Most areas of these soils are too sloping and too erodible for cultivation.

All of the areas are in native grass and are used for grazing. Capability unit VIe–4; windbreak group 10; Opal soil in Clayey range site, Tuthill soil in Sandy range site.

Opal-Woodly complex, 3 to 9 percent slopes (OwC).—This mapping unit is about 70 percent Opal soil, 10 to 20 percent Woodly soil, and 10 to 20 percent other soils. These soils are below gravelly ridges. The Opal soil has a profile similar to the one described as representative of the series, but the surface layer is more loamy and in places contains gravel. The Woodly soil is in lower areas and in swales. It has a profile similar to the one described as representative of the series, but in places scattered pebbles occur throughout the profile.

Included with these soils in mapping are areas of Caputa and Tuthill soils near or in place of Woodly soils.

Opal and Woodly soils have moderate surface runoff. Controlling water erosion and soil blowing is the main concern in management.

Some of the larger areas are cultivated. Winter wheat, corn, sorghum, and alfalfa are the main crops. Other areas are in native grass and are used for grazing and hay. Capability unit IVe–4; Opal soil in Clayey range site, windbreak group 4; Woodly soil in Sandy range site, windbreak group 5.

Orella Series

The Orella series consists of shallow, well-drained, nearly level to rolling or strongly sloping clayey soils on uplands. These soils formed in material weathered from the underlying shale.

In a representative profile the surface layer is light-gray silt loam about 1 inch thick. Below this to a depth of 6 inches is a transition layer of brown clay. It is very hard when dry and very firm when moist. The underlying material to a depth of 13 inches is multicolored, mostly gray and olive-gray clay and soft shale. Below this is gray shale mottled with shades of brown, yellow, and red.

Orella soils are low in organic-matter content and fertility and are high in sodium content. Permeability is very slow, and surface runoff is slow to rapid. Available water capacity is very low.

All areas are in native vegetation and are used for grazing.

Representative profile of Orella clay in an area of Hisle and Orella soils, 0 to 15 percent slopes, 1,380 feet north and 180 feet east of the southwest corner of sec. 28, T. 42 N., R. 31 W.:

A1—0 to 1 inch, light-gray (10YR 7/2) silt loam, dark grayish brown (10YR 4/2) moist; weak, fine, platy and granular structure; soft, very friable; medium and coarse gravel on the surface; neutral; abrupt, broken boundary.

AC—1 to 6 inches, brown (10YR 5/3) clay, grayish brown (10YR 5/2) crushing to brown (10YR 5/3) moist; weak, coarse, prismatic structure parting to weak, medium, blocky; very hard, very firm; many fine fragments of olive shale; strongly alkaline; clear, smooth boundary.

C1—6 to 10 inches, olive (5Y 5/3) and olive-gray (5Y 4/2) clay, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure parting to weak, fine, blocky; very hard, very firm; common fine and medium fragments of shale; strongly alkaline; clear, smooth boundary.

C2—10 to 13 inches, variegated light brownish-gray (10YR 6/2), light yellowish-brown (10YR 6/4), olive-gray (5Y 5/2), and light-gray (5Y 7/2) clay and soft shale; bedded; hard, friable; strongly alkaline; abrupt, wavy boundary.

C3—13 to 30 inches, gray (5Y 5/1), soft shale mottled with yellow, brown, and red; bedded; fracture planes evident; moderately alkaline.

Depth to bedded, soft shale or mudstone ranges from 10 to 20 inches. In some areas the soil is calcareous. The A horizon is commonly light gray or light grayish brown in hues of 10YR or 2.5Y and ranges from silt loam to silty clay. It is commonly less than 1 inch thick, but in places is as much as 3 inches thick. The rest of the profile ranges from 7.5YR through 5Y in hue.

Orella soils are mapped with Hisle soils. In contrast with those soils, they are shallower over shale and do not have a columnar structured B horizon. They contain more sodium and are more alkaline than the nearby Conata soils. They are shallower over shale than the nearby Larvie soils. They also contain more sodium and are more alkaline than Samsil soils, which are shallow over shale. They are more clayey than Epping and Imlay soils, which are shallow over siltstone.

Orella-Badland complex (2 to 12 percent slopes) (Ox).—This mapping unit is 40 to 50 percent Orella soil, 25 to 50 percent Badland, and 10 to 25 percent other soils. The Orella soil is in vegetated areas. The Badland parts are eroding exposures of shale and mudstone on low escarpments and cut banks and along eroding drainageways.

Included in mapping are areas of Conata, Hisle, Imlay, Larvie, and Norrest soils. Hisle soils, the most common of these, are intermingled with Orella soils.

Areas of this complex are not suitable for cultivation. Surface runoff is rapid. Available water capacity in the vegetated areas is low to very low. Permeability is very slow.

All areas are used for grazing. Badland parts are barren of vegetation. Orella soil in Shallow range site, capability unit VIs–3, windbreak group 10; Badland in capability unit VIIIs–2, range site and windbreak group not assigned.

Promise Series

The Promise series consists of deep, moderately well drained to well drained, nearly level to gently sloping, calcareous clayey soils on uplands. These soils formed in clayey material weathered in place from shale or washed in from adjacent slopes.

In a representative profile the surface layer is dark-gray clay about 4 inches thick. The subsoil, about 29 inches thick, is dark-gray clay in the upper part and grayish-brown clay in the lower part. It is extremely hard when dry and extremely firm when moist. The underlying material is light brownish-gray and grayish-brown clay.

Promise soils are medium in organic-matter content and fertility. Permeability is slow to very slow, and surface runoff is slow to moderate. Available water capacity is low to medium.

Many areas are in native grass and are used for grazing and hay. Wheat, corn, sorghum, and alfalfa are the main crops in cultivated areas.

Representative profile of Promise clay, 0 to 2 percent slopes, 1,200 feet south and 90 feet west of the northeast corner of sec. 32, T. 41 N., R. 26 W.:

Ap—0 to 4 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak, very fine, granular structure; hard, firm, slightly sticky; weak, fragile crust on surface crumbles to soft, very friable mulch; slight effervescence; mildly alkaline; abrupt, smooth boundary.

B21—4 to 13 inches, dark-gray (2.5Y 4/1) clay, very dark grayish brown (2.5Y 3/2) moist; darker colored tongues and streaks throughout the horizon; weak, medium and coarse, prismatic structure parting to weak, medium and fine, blocky; extremely hard, extremely firm, very sticky and very plastic; shiny faces on peds; many very fine open pores; slight effervescence; mildly alkaline; gradual, smooth boundary.

B22—13 to 21 inches, dark-gray (2.5Y 4/1) clay, very dark grayish brown (2.5Y 3/2) crushing to dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure parting to weak and moderate, medium and coarse, blocky; extremely hard, extremely firm, very sticky and very plastic; shiny faces on peds; few slickensides that have intersecting surfaces; many very fine open pores; slight effervescence; mildly alkaline; gradual, smooth boundary.

B3—21 to 33 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; darker colored tongues and filled cracks extend into this horizon; weak, coarse, prismatic structure parting to weak, medium and coarse, blocky; extremely hard, extremely firm, very sticky and very plastic; common slickensides that have intersecting surfaces; strong effervescence; moderately alkaline; gradual, smooth boundary.

C1ca—33 to 45 inches, light brownish-gray (2.5Y 6/2) and grayish-brown (2.5Y 5/2) clay, grayish brown (2.5Y 5/2) and dark grayish brown (2.5Y 4/2) moist; weak, coarse and very coarse, prismatic structure; extremely hard, extremely firm, very sticky and very plastic; few slickensides that have intersecting surfaces; common medium and coarse segregations of lime and gypsum; strong effervescence; moderately alkaline; diffuse, smooth boundary.

C2—45 to 60 inches, light brownish-gray (2.5Y 6/2) and grayish-brown (2.5Y 5/2) clay, grayish brown (2.5Y 5/2), light olive brown (2.5Y 5/3), and dark grayish brown (2.5Y 4/2) moist; massive; hard, firm, sticky and plastic; few medium segregations of salts, mostly gypsum; strong effervescence; moderately alkaline.

Depth to bedded shale ranges from 40 to more than 60 inches, but is commonly more than 60 inches. When the soil is dry, cracks as much as 1 inch wide and several feet long extend downward through the profile. The A horizon ranges from dark gray to grayish brown in hues of 10YR or 2.5Y. It is clay or silty clay and ranges from 2 to 8 inches in thickness. The B horizon is 2.5Y or 5Y in hue and ranges from 18 to 32 inches in thickness. The C horizon in places contains fragments of shale.

Promise soils are mapped with Mosher and Opal soils. They do not have the columnar structured B horizon that is typical of Mosher soils, and they contain less sodium than those soils. They commonly have a thicker B horizon than Opal soils and are deeper over shale. They formed in the same kind of clayey material as Kyle and Millboro soils, but they are darker colored than Kyle soils and lack the distinct increase of clay in the B horizon that is typical of Millboro soils.

Promise clay, 0 to 2 percent slopes (PcA).—The profile of this soil is the one described as representative of the series. In places the underlying material is gravelly.

Included with this soil in mapping are areas of Opal soils on slight rises.

This Promise soil takes in water slowly. Surface runoff is slow. The available water capacity is low to medium. Tilth is likely to deteriorate in cultivated areas. Controlling soil blowing, conserving moisture, and improving tilth are all concerns in management.

Many areas are cultivated. Winter wheat, sorghum, alfalfa, and corn are the main crops. Clayey range site; capability unit IIIs–3; windbreak group 4.

Promise clay, 2 to 5 percent slopes (PcB).—This soil has long slopes. Included in mapping are areas of Opal soils on the tops and upper sides of ridges.

This Promise soil takes in water slowly and has moderate surface runoff. Tilth deteriorates in cultivated areas. Controlling water erosion and soil blowing is the main concern in management.

Many areas are cultivated. Winter wheat, sorghum, corn, and alfalfa are the main crops. Other areas are in native grass and are used for grazing and hay. Clayey range site; capability unit IIIe–4; windbreak group 4.

Promise soils (0 to 3 percent slopes) (Pd).—These soils are in small, narrow tracts along upland drainageways. In most of these tracts they are nearly level, but in some slopes are as much as 6 percent. The profile of these soils is similar to the one described as representative of the series, but the surface layer is thicker and in places is silty clay or silty clay loam. In places, recent deposits of sediment are on the surface, and the soil beneath is layered with loamy or gravelly material.

Included with these soils in mapping are areas of Lakoma, Opal, and Samsil soils. All are at the edge of tracts of these Promise soils.

Promise soils take in water slowly and have slow to moderate surface runoff. They commonly receive runoff from adjacent soils. Tilth is poor in cultivated areas.

Most of the acreage is in native grass and is used for grazing. Overflow range site; capability unit IIIs–3; windbreak group 4.

Promise and Opal clays, 0 to 2 percent slopes (PgA).—Some areas of this mapping unit are mainly Promise soils, some are mainly Opal soils, and some contain both soils. Slopes commonly are long and uniform. The surface is uneven because small ridges rise a few inches above the intervening troughs or small valleys. The ridges, about 2 feet wide, are spaced at regular intervals

and extend up and down the slope. In some of the level areas, the ridges and troughs are small mounds and depressions. Each soil has a profile that is similar to the profile described as representative of its respective series. The soils on the small ridges or mounds, however, commonly are lighter colored, and those in the troughs are noncalcareous in the surface layer and upper part of the subsoil.

Included with these soils in mapping are areas of Kyle soils on the small ridges and mounds.

Promise and Opal soils take in water slowly. Surface runoff is slow. Tilth is poor in cultivated areas. Improving tilth and water intake is the main concern in management.

Most of the acreage is in native grass and is used for grazing. Clayey range site; capability unit IIIs–3; windbreak group 4.

Promise and Opal clays, 2 to 5 percent slopes (PgB).—Some areas of this mapping unit are mainly Promise soils, some are mainly Opal soils, and some contain both soils. Slopes commonly are long and uniform. The surface is uneven because small ridges rise a few inches above slightly depressed troughs or small valleys (fig. 6). The ridges, about 2 feet wide, are spaced at regular intervals and extend up and down the slopes. Each soil has a profile that is similar to the profile described as representative of its respective series, but the soils on the small ridges are lighter colored, and those in the troughs commonly are noncalcareous in the surface layer and upper part of the subsoil.

Included with these soils in mapping are areas of Kyle soils on ridges.

Surface runoff is moderate. Controlling water erosion and soil blowing is the main concern in management. Most of the acreage is in native grass and is used for grazing. Clayey range site; capability unit IIIe–4; windbreak group 4.

Promise-Mosher complex, 0 to 2 percent slopes (PmA).—This mapping unit is 70 to 80 percent Promise soils and 20 to 30 percent Mosher soils. These soils are along upland creeks and drainageways. In some areas the surface is uneven because small mounds rise a few inches above the small low areas. The mounds are Promise soils, and the small low areas are Mosher soils.

Included with these soils in mapping are areas of Buffington and Minatare soils. Buffington soils are along creeks. Minatare soils are in the intervening low areas.

Promise and Mosher soils take in water slowly and have slow surface runoff. Tilth is generally poor in cultivated areas. Improving tilth and water intake is the main concern in management.

Most of the acreage is in native grass and is used for grazing. Capability unit IIIs–3; Promise soil in Clayey range site, windbreak group 4; Mosher soil in Claypan range site, windbreak group 9.

Figure 6.—**Promise and Opal clays, 2 to 5 percent slopes. Small ridges and troughs are prominent features of the landscape.**

Promise soils and Slickspots (0 to 3 percent slopes) (Ps).—Promise soils and Slickspots occur together in long, narrow, nearly level areas along drainageways. Proportions of each differ from one area to another. The surface layer of the Promise soil is clay, silty clay, or silty clay loam. In places, recent deposits of sediment are on the surface, and the soil beneath is layered with loamy or gravelly material. Scattered areas of Slickspots, or salt-affected spots, that are bare or sparsely vegetated occur throughout the mapping unit.

Included in mapping are areas of Buffington and Minatare soils. Buffington soils are along some of the larger drainageways. Minatare soils are in or near areas of Slickspots.

The close intermingling of Slickspots with Promise soils makes many areas unsuitable for cultivation. Tilth is poor. Surface runoff is slow to moderate. These soils commonly receive runoff water from adjacent soils.

All the acreage is in native grass and is used for grazing. Promise soil in Overflow range site, capability unit IIIs–3, windbreak group 4; Slickspots in Thin Claypan range site, capability unit VIs–1, windbreak group 10.

Ree Series

The Ree series consists of deep, well-drained, nearly level to gently sloping loamy soils on high terraces or uplands. These soils formed in alluvium derived from different kinds of bedrock.

In a representative profile the surface layer is dark grayish-brown loam about 7 inches thick. The subsoil, about 23 inches thick, is clay loam that is dark grayish brown in the upper part, grayish brown in the middle part, and light yellowish brown in the lower part. The upper part is hard when dry and friable when moist. The lower part is calcareous. The underlying material to a depth of 40 inches is calcareous, light brownish-gray loam. Below this is light yellowish-brown fine sandy loam.

Ree soils are medium in organic-matter content and fertility. Permeability is moderate, and surface runoff is slow to moderate. Available water capacity is high.

Many areas are in native grass and are used for grazing and hay. Wheat, sorghum, oats, corn, and alfalfa are the main crops.

Representative profile of Ree loam in an area of Ree and Keya loams, 0 to 2 percent slopes, 2,520 feet south and 1,110 feet west of the northwest corner of sec. 26, T. 41 N., R. 27 W.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) crushing to very dark grayish brown (10YR 3/2) moist; cloddy with weak, medium, granular structure; slightly hard, friable; neutral; abrupt, smooth boundary.

B21t—7 to 14 inches, dark grayish-brown (10YR 4/2) clay loam, dark brown (10YR 3/3) moist; peds coated very dark grayish brown (10YR 3/2) moist; moderate, fine, prismatic structure parting to moderate, fine and medium, subangular blocky; hard, friable, slightly sticky; thin, continuous clay films; mildly alkaline; clear, smooth boundary.

B22t—14 to 24 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) crushing to olive brown (2.5Y 4/3) moist; peds coated dark grayish brown (10YR 4/2), very dark grayish brown (10YR 3/2) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; very hard, very firm, slightly sticky; thin, continuous clay films; mildly alkaline; gradual, smooth boundary.

B3—24 to 30 inches, light yellowish-brown (2.5Y 6/3) clay loam, light olive brown (2.5Y 5/3) moist; peds coated grayish brown (10YR 5/2), dark grayish brown (10YR 4/2) moist; weak, medium and coarse, prismatic structure parting to moderate, medium, subangular blocky and blocky; hard, friable; thin, continuous clay films; strong effervescence; moderately alkaline; gradual, smooth boundary.

C1ca—30 to 40 inches, light brownish-gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; weak, coarse, prismatic structure; hard, friable; thin, very patchy clay films; common medium segregations of lime; violent effervescence; moderately alkaline; diffuse, smooth boundary.

C2—40 to 60 inches, light yellowish-brown (2.5Y 6/3) fine sandy loam, light olive brown (2.5Y 5/3) moist; massive; soft, very friable; strong effervescence; moderately alkaline.

Depth to lime ranges from 15 to 30 inches. A few pebbles commonly occur throughout the soil. The A horizon is commonly loam, but ranges from very fine sandy loam to light silty clay loam. It ranges from 3 to 8 inches in thickness. The B horizon is commonly heavy loam or clay loam, but in places the lower part is sandy clay loam. This horizon ranges from 16 to 28 inches in thickness. The C horizon is loam, sandy clay loam, or fine sandy loam, but in some profiles sand and gravel are at a depth ranging from 40 to 60 inches.

Ree soils are mapped with Keya soils and are commonly near Altvan, Caputa, Lowry, Savo, and Tuthill soils. They have a thinner A horizon than Keya soils. They are deeper over sand and gravel than Altvan soils. They are less silty and have a less clayey B horizon than Caputa and Savo soils. They are less sandy than Tuthill soils.

Ree loam, 2 to 5 percent slopes (ReB).—This soil is on fans at the mouths of small streams or drainageways that empty onto terraces or upland flats. It has a profile similar to the one described as representative of the series, but the surface layer and subsoil contain more gravel and in places recently deposited loamy to gravelly material is on the surface.

This Ree soil has moderate surface runoff and receives runoff from other areas in some years. Available water capacity is high. Controlling erosion is the main concern in management.

Most areas are in native grass and are used for grazing or hay. Silty range site; capability unit IIe–1; windbreak group 3.

Ree and Keya loams, 0 to 2 percent slopes (RkA).—This mapping unit consists of Ree and Keya soils in proportions that differ from one area to another. The Ree soil is on very slight rises. It has the profile described as representative of the series. The Keya soil is in broad swales or slightly depressed flats. It is described under the heading "Keya Series."

Included with these soils in mapping are areas of Altvan, Dunday, Lowry, Minatare, Savo, and Woodly soils. Altvan soils, the most common of these, are less than 40 inches deep over gravel. Dunday and Woodly soils are in sandy areas. Lowry and Savo soils are in places where the terraces are mantled with silty material. Minatare soils and Slickspots are in some of the low areas. Inclusions commonly make up less than 15 percent of a given mapped area.

Ree and Keya soils are medium to high in fertility and are easy to work. Surface runoff is slow. Available water capacity is medium to high. Conserving moisture is the main concern in management.

Many areas are cultivated. Winter wheat, sorghum, and alfalfa are the main crops. Capability unit IIc–2; Ree soil in Silty range site, windbreak group 3; Keya soil in Overflow range site, windbreak group 1.

Ree and Keya loams, 2 to 5 percent slopes (RkB).—This mapping unit consists of Ree and Keya soils in proportions that differ from one area to another. The Ree soil is generally dominant. It has a profile similar to the one described as representative of the series, but in places the surface layer is thinner. The Keya soil is on foot slopes and in swales. It has the profile described as representative of the Keya series.

Included with these soils in mapping are areas of Altvan, Dunday, Lowry, Savo, and Woodly soils. Altvan soils, the most common of these, are less than 40 inches deep over gravel. Dunday and Woodly soils are in small areas mantled with wind-deposited sand. Lowry and Savo soils are in some areas where this mantle is more silty.

Ree and Keya soils have slow to moderate surface runoff. Controlling erosion is the main concern in management.

Winter wheat, sorghum, and alfalfa are the main crops in cultivated areas. Other areas are in native grass and are used for grazing and hay. Silty range site; capability unit IIe–1; Ree soil in windbreak group 3, Keya soil in windbreak group 1.

Reliance Series

The Reliance series consists of deep, well-drained, gently sloping to sloping silty soils on uplands. These soils formed in silty loess.

In a representative profile the surface layer is dark grayish-brown silty clay loam about 5 inches thick. The subsoil, about 27 inches thick, is dark grayish-brown and grayish-brown silty clay and clay that is hard when dry and firm when moist. The lower part is calcareous. The underlying material is calcareous, light brownish-gray clay and clay loam.

Reliance soils are medium in organic-matter content and fertility. Permeability is moderately slow, and surface runoff is moderate. Available water capacity is medium to high.

Many areas are cultivated. Wheat, corn, sorghum, and alfalfa are the main crops. Other areas are in native grass and are used for grazing and hay.

The Reliance soils in Mellette County are mapped only with Millboro soils.

Representative profile of Reliance silty clay loam in an area of Millboro-Reliance complex, 2 to 5 percent slopes, 2,590 feet east and 420 feet north of the southwest corner of sec. 36, T. 41 N., R. 26 W.:

Ap—0 to 5 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; cloddy with weak, fine, granular structure; slightly hard, friable; neutral; abrupt, smooth boundary.

B21t—5 to 14 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak, medium, prismatic structure parting to moderate, fine, subangular blocky and blocky; hard, firm; thin, continuous clay films; mildly alkaline; clear, wavy boundary.

B22t—14 to 24 inches, grayish-brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate, medium, prismatic structure parting to moderate, fine, subangular blocky; hard, firm; thin, continuous clay films; mildly alkaline; clear, wavy boundary.

B3ca—24 to 32 inches, grayish-brown (2.5Y 5/2) clay crushing to light brownish gray (2.5Y 6/2), dark grayish brown (2.5Y 4/2) moist; moderate, medium, prismatic structure parting to weak, fine, subangular blocky; hard, firm; thin, continuous and patchy clay films; few segregations of lime; violent effervescence; moderately alkaline; clear, wavy boundary.

C1ca—32 to 40 inches, light brownish-gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak, medium, prismatic structure; hard, friable; thin, patchy clay films; many segregations of lime; violent effervescence; moderately alkaline; gradual, wavy boundary.

C2—40 to 50 inches, light brownish-gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable; violent effervescence; moderately alkaline; gradual boundary.

C3—50 to 60 inches, light brownish-gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable; many pinholes; violent effervescence; moderately alkaline.

Depth to lime ranges from 20 to 30 inches. The A horizon is dark gray or dark grayish brown in hue of 10YR and is 3 to 7 inches thick. It is commonly silty clay loam, but ranges from silt loam to light silty clay. The B2t horizon is 10YR or 2.5Y in hue and is heavy silty clay loam or silty clay that is 35 to 45 percent clay. The B3ca horizon ranges from silty clay loam or clay loam to silty clay or clay. The C horizon ranges from loam to clay. In places bedded shale is at a depth ranging from 40 to 60 inches.

Reliance soils are mapped with Millboro soils and are near Caputa, Opal, and Promise soils. They have a more silty and less sandy B horizon than Caputa soils. They are more silty and less clayey than Millboro, Opal, and Promise soils. They are similar to Savo soils, but have a thicker B horizon and are calcareous at a greater depth.

Samsil Series

The Samsil series consists of shallow, well-drained to excessively drained, sloping to steep, calcareous clayey soils on uplands. These soils formed in material weathered from the underlying shale.

In a representative profile the surface layer is light brownish-gray clay about 3 inches thick. Below this is a transition layer of light-gray and grayish-brown clay that is hard when dry and friable when moist. The underlying material to a depth of 17 inches is light brownish-gray shaly clay. Below this is olive-gray shale.

Samsil soils are low in organic-matter content and fertility. Permeability is slow, and surface runoff is moderate to rapid. Available water capacity is very low.

Almost all areas are in native grass and are used for grazing.

Representative profile of Samsil clay, 15 to 40 percent slopes, 180 feet north and 120 feet east of the center of sec. 20, T. 42 N., R. 28 W.:

A1—0 to 3 inches, light brownish-gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; weak, very fine, platy structure and weak, fine, granular; slightly hard, friable, sticky; slight effervescence; moderately alkaline; abrupt, smooth boundary.

AC—3 to 8 inches, light-gray (2.5Y 7/1) and grayish-brown (2.5Y 5/2) clay, grayish brown (2.5Y 5/2) moist; weak, medium, prismatic structure parting to weak, fine and medium, subangular blocky; hard, friable, sticky and slightly plastic; root channels stained with darker colors; many very fine shale fragments; slight effervescence; moderately alkaline; clear, wavy boundary.

C1—8 to 17 inches, light brownish-gray (2.5Y 6/2) shaly clay, dark grayish brown (2.5Y 4/2) moist; massive

with distinct bedding planes; hard, firm; more than 40 percent chips and fragments of partially weathered shale; few stains of yellowish brown; common fine segregations of gypsum; slight effervescence; mildly alkaline; clear, smooth boundary.

C2—17 to 28 inches, olive-gray (5Y 5/2), soft shale; bedded with platy structure of bedrock; hard, but brittle; plates stained with black and olive brown; few nests of gypsum in seams; slight effervescence; mildly alkaline.

Depth to bedded shale ranges from 8 to 20 inches. A thin crust or a mulch of fine granules is commonly on the surface. Very fine fragments of shale make the soil easy to dig. The A horizon ranges from grayish brown to light gray in hues of 10YR through 5Y. It is clay or silty clay and is 2 to 4 inches thick. In some profiles the C horizon contains few to many fine and medium segregations of lime.

Samsil soils are mapped with Lakoma soils and are near Opal soils. They are shallower over shale than those soils. They contain less sodium and are less alkaline than Orella soils. They are more friable than Conata soils. They are less silty and more clayey than Epping and Imlay soils.

Samsil clay, 15 to 40 percent slopes (SaE).—This soil is on the sides of buttes, ridges, and deeply dissected stream valleys. Many drainageways are in the areas. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Hisle, Lakoma, Minatare, Opal, and Promise soils. Hisle, Minatare, and Promise soils are in low areas along drainageways. Lakoma and Opal soils are in the lower parts of the areas and also on some of the wider ridges.

This Samsil soil is not suitable for cultivation. Surface runoff is rapid, and available water capacity is very low. All areas are in native grass and are used for grazing. Shallow range site; capability unit VIIs–2; windbreak group 10.

Samsil-Lakoma clays, 9 to 15 percent slopes (SlD).—This mapping unit is 50 to 65 percent Samsil soil and 35 to 50 percent Lakoma soil. These soils are on the sides of ridges, drainageways (fig. 7), and stream valleys. The Samsil soil is in the steeper, upper parts of these areas, and the Lakoma is in the less steep, lower parts. The Lakoma soil is described under the heading "Lakoma Series."

Included with these soils in mapping are areas of Opal and Promise soils. Opal soils are in the less steep, more stable parts of the landscape. Promise soils are on foot slopes and along drainageways.

Samsil and Lakoma soils are too erodible and too droughty for cultivation. Surface runoff is moderate to rapid, and available water capacity is low to very low.

All areas are in native grass and are used for grazing. Capability unit VIs–3; windbreak group 10; Samsil soil in Shallow range site, Lakoma soil in Clayey range site.

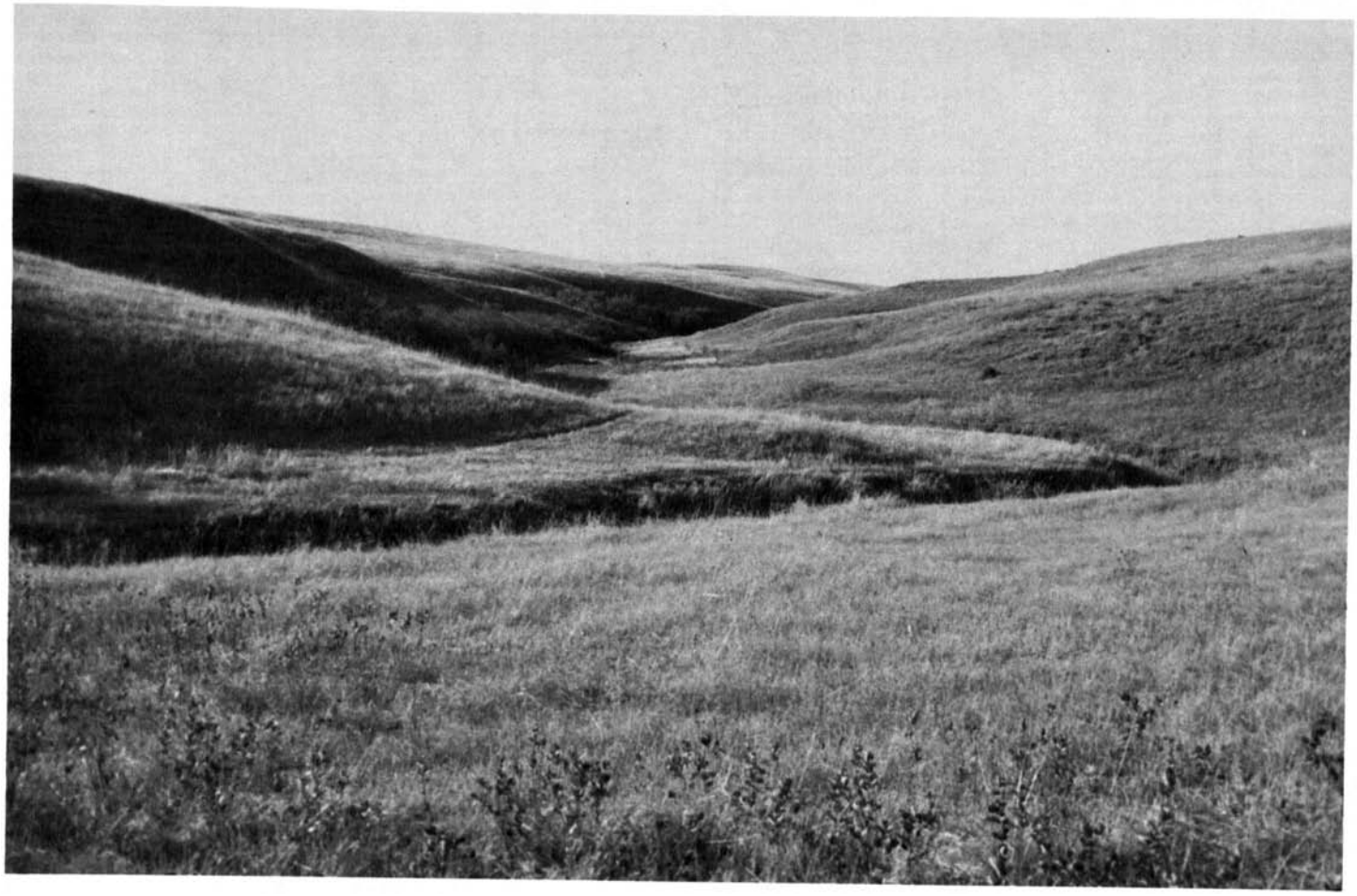

Figure 7.—**Drainageway in an area of Samsil-Lakoma clays, 9 to 15 percent slopes.**

Samsil-Lakoma clays, 15 to 40 percent slopes (SlE).—This mapping unit is 60 to 80 percent Samsil soil and 20 to 40 percent Lakoma soil. These soils are on the sides of buttes, ridges, drainageways, and stream valleys. These areas are commonly gullied and contain many drainageways that have short slopes. The Samsil soil is generally in the steeper, higher parts of the areas and at the heads of drainageways. The Lakoma soil is in the lower, less steep parts of the areas. The Lakoma soil is described under the heading "Lakoma Series."

Included with these soils in mapping are small areas of Opal and Promise soils. Opal soils are on narrow, gently sloping ridges. Promise soils are on foot slopes and along drainageways.

Samsil and Lakoma soils are not suitable for cultivation. Surface runoff is rapid, and available water capacity is low to very low.

All areas are in native grass and are used for grazing. Capability unit VIIs–2; windbreak group 10; Samsil soil in Shallow range site, Lakoma soil in Clayey range site.

Samsil-Manter complex, 15 to 40 percent slopes (SmE).—This mapping unit is 50 to 65 percent Samsil soil, 15 to 30 percent Manter soil, and 20 percent other soils. The Manter soil is on some of the ridges and slopes that are blanketed with wind-deposited sand. It is described under the heading "Manter Series."

Included with these soils in mapping are areas of Anselmo, Lakoma, Opal, Promise, Tuthill, and Valentine soils. Anselmo, Tuthill, and Valentine soils are in some of the sandy areas. Lakoma and Opal soils are in the less steep, clayey areas. Promise soils are on foot slopes and along drainageways.

Samsil and Manter soils are not suitable for cultivation. Surface runoff is moderate to rapid. Water erosion and soil blowing are hazards.

All areas are in native grass and are used for grazing. Capability unit VIIs–2; windbreak group 10; Samsil soil in Shallow range site, Manter soil in Sandy range site.

Samsil-Schamber complex, 15 to 40 percent slopes (SnE).—This mapping unit is 70 to 80 percent Samsil soil and 20 to 30 percent Schamber soil. These soils are on valley sides along the White and Little White Rivers and on steep fronts of high terraces. The Samsil soil is on the mid and lower parts of the areas, and the Schamber soil is on the upper parts on rounded, narrow ridges. The Samsil soil has a profile similar to the one described as representative of the series, but in places the surface layer is loam or sandy loam. The Schamber soil has the profile described as representative of the Schamber series.

Included with these soils in mapping are areas of Lakoma and Murdo soils. Lakoma soils are in the lower parts of the areas. Murdo soils are near the Schamber soils.

Samsil and Schamber soils are not suitable for cultivation. Surface runoff is moderate to rapid. Available water capacity is very low.

All areas are in native grass and are used for grazing. Capability unit VIIs–2; windbreak group 10; Samsil soil in Shallow range site, Schamber soil in Very Shallow range site.

Samsil-Shale outcrop complex (15 to 40 percent slopes) (Ss).—This mapping unit is 70 percent Samsil soil, 20 percent Shale outcrop, and 10 percent other soils. Small eroded areas of shale or mudstone are scattered throughout the mapped areas around the heads of drainageways, on low buttes, and on cut-bank escarpments. Many eroding drainageways commonly are in the areas.

Included in mapping are areas of Conata, Imlay, Lakoma, and Larvie soils. Differences in the kind of shale or mudstone underlying the areas determine the location of these inclusions.

Areas of this complex have rapid surface runoff and are subject to severe geologic erosion. All soil areas are in native grass and are used for grazing. Shale outcrop areas have a sparse vegetative cover or are barren. Samsil soil in Shallow range site, capability unit VIIs–2, windbreak group 10; Shale outcrop in capability unit VIIIs–2, range site and windbreak group not assigned.

Sandy Land

Sandy land (10 to 25 percent slopes) (St) is 30 to 80 percent undifferentiated sandy soils and 20 to 70 percent claypan soils. The sandy soils, similar to Dunday and Valentine soils, are intermingled with Anselmo, Manter, and Tuthill soils. The claypan soils, similar to Whitelake soils, are in low places between undulations of the sandy soils. Included in mapping are a few areas of Larvie soils.

Sandy land is subject to soil blowing if the surface is disturbed. Root development is restricted in the claypan soils.

All areas are in native grass and are used for grazing. Sands range site; capability unit VIe–7; windbreak group 10.

Savo Series

The Savo series consists of deep, well-drained, nearly level to gently sloping silty soils on terraces and uplands. These soils formed in silty material deposited by wind or water.

In a representative profile the surface layer is dark-gray silty clay loam about 4 inches thick. The subsoil, about 16 inches thick, is silty clay loam that is dark gray in the upper part, grayish brown and dark grayish brown in the middle part, and light brownish gray in the lower part. The middle part is very hard when dry and very firm when moist. The lower part is calcareous. The underlying material to a depth of 58 inches is calcareous, light brownish-gray silty clay loam. Below this is calcareous, multicolored sand and gravel.

Savo soils are medium in organic-matter content and fertility. Permeability is moderately slow, and surface runoff is slow to moderate. Available water capacity is medium to high.

Many areas are cultivated. Wheat, sorghum, oats, corn, and alfalfa are the main crops. Other areas are in native grass and are used for grazing and hay.

Representative profile of Savo silty clay loam, 0 to 2 percent slopes, 540 feet north and 520 feet east of the center of sec. 27, T. 41 N., R. 27 W.:

Ap—0 to 4 inches, dark-gray (10YR 4/1) silty clay loam, black (10YR 2/1) crushing to very dark brown

(10YR 2/2) moist; weak, fine, granular and subangular blocky structure; soft, friable; neutral; abrupt, smooth boundary.

B21t—4 to 10 inches, dark-gray (10YR 4/1) silty clay loam, very dark brown (10YR 2/2) crushing to very dark grayish brown (10YR 3/2) moist; moderate, medium, prismatic structure parting to moderate, fine, subangular blocky; hard, friable; thin, patchy clay films on faces of peds; neutral; clear, smooth boundary.

B22t—10 to 16 inches, grayish-brown (2.5Y 5/2) and dark grayish-brown (2.5Y 4/2) heavy silty clay loam, very dark grayish brown (2.5Y 3/2) crushing to dark grayish brown (2.5Y 4/2) moist; moderate, medium and coarse, prismatic structure parting to moderate, medium, blocky; very hard, very firm; thin, continuous clay films on faces of peds; neutral; clear, smooth boundary.

B3—16 to 20 inches, light brownish-gray (2.5Y 6/2) heavy silty clay loam, grayish brown (2.5Y 5/3) moist; moderate, medium and coarse, prismatic structure parting to moderate, medium, subanglar blocky; very hard, very firm; many very fine pores; strong effervescence; mildly alkaline; clear, wavy boundary.

C1ca—20 to 40 inches, light brownish-gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/3) moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; very hard, firm; many fine pores; common medium segregations of lime; violent effervescence; moderately alkaline; gradual, smooth boundary.

C2ca—40 to 58 inches, light brownish-gray (2.5Y 6/2) light silty clay loam, grayish brown (2.5Y 5/3) moist; massive; very hard, friable; common medium segregations of lime; violent effervescence; moderately alkaline; clear, smooth boundary.

IIC3—58 to 60 inches, multicolored sand and gravel; single grained; loose; strong effervescence.

Depth to lime ranges from 12 to 20 inches. The A horizon ranges from dark gray to grayish brown in hue of 10YR. It is silty clay loam or silt loam and is 2 to 6 inches thick. The B horizon is silty clay loam or silty clay that ranges from 35 to 50 percent in clay content. The B horizon ranges from 12 to 19 inches in thickness. The C horizon is silty clay loam or silt loam. The Cca horizon contains few to common, fine to medium segregations of lime. Sand and gravel, between a depth of 40 to 60 inches, occur in some profiles.

Savo soils are near Lowry and Ree soils and have profiles similar to those of Caputa and Reliance soils. They have a more clayey B horizon than Lowry and Ree soils. They are more silty than Caputa soils. They have a thinner B horizon and are shallower over lime than Reliance soils.

Savo silty clay loam, 0 to 2 percent slopes (SuA).—This soil is on high terraces and uplands. It has the profile described as representative of the series.

Included with this soil in mapping are areas of Keya, Promise, Ree, and Woodly soils. Keya and Woodly soils are in swales. Ree soils are in the less silty areas. Promise soils are on clayey flats or along drainageways.

This Savo soil has slow surface runoff. Permeability is moderately slow, and available water capacity is medium to high. The main concerns in management are conserving moisture and controlling soil blowing.

Winter wheat, sorghum, corn, and alfalfa are the main crops in cultivated areas. Other areas are in native grass and are used for grazing and hay. Silty range site; capability unit IIc–2; windbreak group 3.

Savo silty clay loam, 2 to 5 percent slopes (SuB).—This soil is on high terraces and uplands. Included with this soil in mapping are areas of Altvan, Keya, Promise, and Ree soils.

This Savo soil has moderate surface runoff. The main concern in management is controlling water erosion and soil blowing.

Winter wheat, sorghum, corn, and alfalfa are the main crops in cultivated areas. Other areas are in native grass and are used for grazing or hay. Silty range site; capability unit IIe–1; windbreak group 3.

Savo silty clay loam, 5 to 9 percent slopes (SuC).—This soil has a profile similar to the one described as representative of the series, but the surface layer is slightly thinner. Included with this soil in mapping are areas of Altvan, Keya, Lowry, Murdo, and Ree soils.

This Savo soil has moderate surface runoff. Controlling water erosion and soil blowing is the main concern in management.

Most areas are in native grass and are used for grazing. Silty range site; capability unit IIIe–1; windbreak group 3.

Schamber Series

The Schamber series consists of well-drained to excessively drained, strongly sloping to steep loamy soils that are very shallow over sand and gravel. These soils formed in a thin layer of loam or gravelly loam material over sand and gravel. They are on terraces or the remnants of terraces on uplands.

In a representative profile the surface layer is gravelly loam about 6 inches thick. It is grayish brown in the upper part and is brown and calcareous in the lower part. Below this is calcareous, light brownish-gray sand and gravel.

Schamber soils are low in organic-matter content and fertility. Permeability is rapid, and surface runoff is moderate to rapid. Available water capacity is low to very low.

All areas are in native grass and are used for grazing.

Representative profile of Schamber gravelly loam in an area of Samsil-Schamber complex, 15 to 40 percent slopes, 1,200 feet north and 510 feet west of the southeast corner of sec. 11, T. 44 N., R. 32 W.:

A11—0 to 2 inches, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular and subangular blocky structure; slightly hard, friable; neutral; abrupt, smooth boundary.

A12—2 to 6 inches, brown (10YR 5/3) gravelly loam, dark grayish brown (10YR 4/2) moist; weak, fine, granular and subangular blocky structure; slightly hard, friable; strong effervescence; moderately alkaline; clear, wavy boundary.

C1ca—6 to 20 inches, light brownish-gray (10YR 6/2) sand and gravel, grayish brown (10YR 5/2) moist; single grained; loose; many white masses of segregated lime; lime coatings on lower sides of pebbles; strong effervescence; moderately alkaline; gradual, smooth boundary.

C2ca—20 to 60 inches, multicolored sand and gravel; single grained; loose; common masses and coatings of segregated lime in upper part, few in lower part; strong effervescence; moderately alkaline.

The A horizon ranges from grayish brown to pale brown in hue of 10YR. It is gravelly loam or loam and ranges from 4 to 10 inches in thickness. In some profiles the C1ca horizon is gravelly sandy loam, loamy sand, or sand.

The Schamber soils in this county are mapped with Murdo and Samsil soils. They are shallower over sand and gravel than Murdo soils.

Schamber-Murdo gravelly loams, 15 to 25 percent slopes (SvE).—This mapping unit is about 70 percent Schamber soil and about 30 percent Murdo soil. The Schamber soil is generally in the steeper, upper parts of the areas. The Murdo soil is in the less steep parts and on ridges. The Murdo soil is described under the heading "Murdo Series."

Included in the areas mapped near Badland are small amounts of Conata, Imlay, and Larvie soils. These soils are in places where gravel deposits are thin.

Schamber and Murdo soils are too droughty and too steep for cultivation. All areas are in native grass and are used for grazing. Capability unit VIIs–4; windbreak group 10; Schamber soil in Very Shallow range site, Murdo soil in Shallow to Gravel range site.

Schamber-Samsil complex, 15 to 40 percent slopes (SwE).—This mapping unit is about 60 percent Schamber soil and about 40 percent Samsil soil. These soils are on edges of terraces above the larger streams and on scattered ridges on uplands. The Schamber soil is on the higher parts of the areas. The Samsil soil is on the lower parts of the areas. The Samsil soil has a profile similar to the one described as representative of its series, but in places the soil has a thin loam or gravelly loam surface layer.

Included with these soils in mapping are areas of Lakoma and Murdo soils. Lakoma soils are on the lower parts of the area. Murdo soils are intermingled with Schamber soils.

Schamber and Samsil soils are not suitable for cultivation. Surface runoff is rapid. All areas are in native grass and are used for grazing. Capability unit VIIs–4; windbreak group 10; Schamber soil in Very Shallow range site, Samsil soil in Shallow range site.

Stirk Series

The Stirk series consists of deep, moderately well drained to well drained, nearly level, calcareous clayey soils on bottom land or along upland streams. These soils formed in clayey alluvium.

In a representative profile the surface layer is light-gray clay about 1 inch thick. Below this is about 6 inches of gray and light brownish-gray clay that is extremely hard when dry and extremely firm when moist. The underlying material is light-gray clay stratified with thin lenses of coarser material.

Stirk soils are low in organic-matter content and fertility. Permeability is slow to very slow, and surface runoff is slow. Most areas are subject to flooding. Available water capacity is low to medium.

Almost all the areas are in native grass and are used for grazing or hay.

Representative profile of Stirk clay, 2,300 feet east and 690 feet north of the southwest corner of sec. 25, T. 42 N., R. 32 W.:

A1—0 to 1 inch, light-gray (10YR 7/1) clay, light brownish gray (10YR 6/2) moist; smooth, platy crust on surface; weak, fine, subangular blocky structure parting to weak, fine, granular beneath; hard, friable, sticky and slightly plastic; strong effervescence; moderately alkaline; abrupt, smooth boundary.

C1—1 to 7 inches, gray (10YR 5/1) and light brownish-gray (10YR 6/2) clay, dark gray (10YR 4/1) and dark grayish brown (10YR 4/2) crushing to grayish brown (10YR 5/2) moist; weak, medium and coarse, prismatic structure parting to weak, coarse and fine, subangular blocky; extremely hard, extremely firm, very sticky and very plastic; strong effervescence; moderately alkaline; clear, smooth boundary.

C2—7 to 60 inches, light-gray (2.5Y 7/2) clay, light brownish gray (2.5Y 6/2) moist; weak, coarse, prismatic structure parting to weak, coarse, subangular blocky; extremely hard, extremely firm, very sticky and very plastic; stratified with thin lenses of coarser material; few fine segregations of salts; strong effervescence; moderately alkaline; clear, wavy boundary.

The profile commonly is stratified with thin lenses of silty clay, silty clay loam, clay loam, and silt loam. Clay content between a depth of 10 and 40 inches averages more than 60 percent. Below 40 inches, the soil ranges from clay to sandy loam. When the soil is dry, cracks as much as 3 inches wide extend downward to a depth of 20 inches or more. The A horizon ranges from dark gray to light gray in hues of 10YR through 5Y and is 1 to 4 inches thick. The C horizon commonly has buried, dark-colored layers below a depth of 30 inches in some profiles.

Stirk soils are near Buffington and Haverson soils. They are more clayey than Buffington and Haverson soils. They are more poorly drained than Kyle soils.

Stirk clay (0 to 4 percent slopes) (Sy).—This soil is on bottom land along drainageways and creeks, mainly in and near the Badland parts of the county. Areas are small and irregularly shaped. Slopes are mostly nearly level, but range to as much as 4 percent in places where gently sloping fans are included.

This soil has poor tilth. Surface runoff is slow, and the areas are subject to flooding. All areas are in native grass and are used for grazing or hay. Overflow range site; capability unit VIs–1; windbreak group 10.

Tuthill Series

The Tuthill series consists of deep, well-drained, nearly level to undulating or sloping loamy soils on uplands and terraces. These soils formed in eolian sand.

In a representative profile the surface layer is grayish-brown fine sandy loam about 3 inches thick. The subsoil, about 36 inches thick, is dark-brown fine sandy loam in the upper part, brown sandy clay loam in the middle part, and light brownish-gray sandy loam in the lower part. The middle part is very hard when dry and friable when moist. The underlying material is pale-brown loamy sand.

Tuthill soils are medium in organic-matter content and fertility. Permeability is moderate, and surface runoff is slow to moderate. Available water capacity is medium.

Many areas are in native grass and are used for grazing and hay. Wheat, corn, sorghum, and alfalfa are the main crops.

Representative profile of Tuthill fine sandy loam in an area of Manter-Tuthill fine sandy loams, 6 to 9 percent slopes, 573 feet east and 57 feet north of the southwest corner of sec. 20, T. 40 N., R. 30 W.:

A1—0 to 3 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak, fine, granular and subangular blocky structure; soft, very friable; neutral; clear, smooth boundary.

B21t—3 to 8 inches, dark-brown (7.5YR 4/2) heavy fine sandy loam, dark brown (7.5YR 3/2) moist; weak, medium, prismatic structure parting to weak, coarse, blocky; hard, friable, sticky; neutral; clear, smooth boundary.

B22t—8 to 17 inches, brown (7.5YR 5/2) light sandy clay loam, dark brown (7.5YR 4/2) moist; moderate,

medium and coarse, prismatic structure parting to weak, coarse, blocky; very hard, friable, very sticky; thin, continuous clay films that have bridging between sand grains; neutral; gradual, smooth boundary.

B23t—17 to 24 inches, brown (7.5YR 5/2) light sandy clay loam, dark brown (7.5YR 4/2) moist; moderate, coarse, prismatic structure parting to moderate, coarse, blocky; very hard, friable, very sticky; thin, continuous clay films on faces of prisms; neutral; gradual, smooth boundary.

B3—24 to 39 inches, light brownish-gray (10YR 6/2) heavy sandy loam, dark grayish brown (10YR 4/2) moist; weak, coarse, prismatic structure; hard, friable, sticky; thin, patchy clay films; neutral; gradual, smooth boundary.

C—39 to 60 inches, pale-brown (10YR 6/3) loamy sand, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable; mildly alkaline.

Depth to lime ranges from 36 inches to more than 60 inches. The A horizon is grayish brown or dark grayish brown in hue of 10YR. It is commonly fine sandy loam, but in some profiles is loam or silt loam. It ranges from 3 to 9 inches in thickness. The B2t horizon is heavy sandy loam or sandy clay loam and ranges from 12 to 25 inches in thickness. The C horizon is commonly loamy sand, but ranges from loam to fine sand below a depth of 40 inches. In places shale, siltstone, or sand and gravel are at a depth ranging from 40 to 60 inches.

Tuthill soils are mapped with Manter, Whitelake, and Woodly soils. They are commonly near Caputa and Ree soils. They have a more clayey B horizon than Manter and Whitelake soils. They have a less clayey B horizon than Caputa soils. They have a more sandy B horizon than Ree soils. They have a thinner A horizon than Woodly soils.

Tuthill fine sandy loam, 3 to 6 percent slopes (ThB).—This soil has a profile similar to the one described as representative of the series, but the surface layer is slightly thicker.

Included with this soil in mapping are areas of Anselmo, Larvie, Manter, Norrest, and Ree soils. Anselmo and Manter soils are intermingled with Tuthill soils in some areas. Larvie, Norrest, and Ree soils are in places where the wind-deposited sandy material is thin or missing.

This Tuthill soil has moderate surface runoff. Controlling water erosion and soil blowing is the main concern in management.

Many areas are in native grass and are used for grazing or hay. Alfalfa is the main crop, but winter wheat and sorghum also are grown. Sandy range site; capability unit IIIe–8; windbreak group 5.

Tuthill-Opal complex, 2 to 9 percent slopes (ToC).—This mapping unit is 60 to 80 percent Tuthill soil and 20 to 40 percent Opal soil. The Opal soil is in places where the wind-deposited sandy material is thin over the underlying clay or shale. The Tuthill soil has a profile similar to the one described as representative of its series, but in places clay or shale is at a depth ranging from 40 to 60 inches. The Opal soil has a profile similar to the one described as representative of its series, but the surface layer is loam to clay loam.

Included with these soils in mapping are areas of Anselmo, Manter, and Promise soils. Anselmo and Manter soils are intermingled with Tuthill soils. Promise soils are near Opal soils.

Tuthill and Opal soils have moderate surface runoff. The Tuthill soil has better tilth, is more permeable, and has higher available water capacity than the Opal soil. Controlling water erosion and soil blowing is the main concern in management.

Many areas are in native grass and are used for grazing. Alfalfa, sorghum, and winter wheat are the main crops. Capability unit IVe–8; Tuthill soil in Sandy range site, windbreak group 5; Opal soil in Clayey range site, windbreak group 4.

Tuthill and Whitelake fine sandy loams, 0 to 5 percent slopes (TuB).—This mapping unit consists of Tuthill and Whitelake soils in proportions that differ from one area to another. Many areas are on terraces along streams and upland drainageways. The Tuthill soil is on undulations or rises. It has a profile similar to the one described as representative of its series, but the surface layer is slightly thicker. The Whitelake soil is in the lower, more level areas. It has a profile similar to the one described as representative of its series, but in places the surface layer is thinner.

Included with these soils in mapping are areas of Woodly soils in some of the low areas. Also included are claypan soils that are similar to Whitelake soils, but have a very thin surface layer.

Tuthill and Whitelake soils have slow surface runoff. The claypan subsoil of the Whitelake soil restricts root development. Soil blowing is a hazard if the surface is disturbed.

Most areas are in native grass and are used for grazing. Sandy range site; windbreak group 5; Tuthill soil in capability unit IIIe–8, Whitelake soil in capability unit IVe–13.

Tuthill-Woodly fine sandy loams, 0 to 3 percent slopes (TwA).—This mapping unit is about 60 percent Tuthill soil, about 30 percent Woodly soil, and 10 percent other soils. The Tuthill soil is on slight rises. It has a profile similar to the one described as representative of its series, but the surface layer is thicker and is loam in a few places. The Woodly soil is in the lower areas. It is described under the heading "Woodly Series."

Included with these soils in mapping are areas of Anselmo and Manter soils on the upper parts of slight rises, adjacent to Tuthill soils. Also included in some areas are any of several soils that formed in material underlying the wind-deposited sand.

Tuthill and Woodly soils are medium to high in fertility and have medium to high available water capacity. Surface runoff is slow. Soil blowing is a hazard. Controlling soil blowing is the main concern in management.

Alfalfa, winter wheat, and sorghum are the main crops. Other areas are in native grass and are used for grazing or hay. Sandy range site: capability unit IIIe–7; windbreak group 5.

Tuthill-Woodly fine sandy loams, 3 to 6 percent slopes (TwB).—This mapping unit is 60 to 70 percent Tuthill soil, 20 to 30 percent Woodly soil, and 10 percent other soils. The Tuthill soil is on rises. It has a profile similar to the one described as representative of the Tuthill series, but the surface layer is slightly thicker and is loam in a few places. The Woodly soil is in swales and low areas between rises. It has the profile described as representative of the Woodly series.

Included with these soils in mapping are areas of Anselmo and Manter soils on the upper parts of rises, adjacent to Tuthill soils. Also included, in some areas

where the mantle of sand is thin or missing, are silty to clayey soils that formed in material underlying wind-deposited sand.

Tuthill and Woodly soils have slow to moderate surface runoff. Controlling water erosion and soil blowing is the main concern in management.

Alfalfa, winter wheat, and sorghum are the main crops. Other areas are in native grass and are used for grazing or hay. Sandy range site; capability unit IIIe–8; windbreak group 5.

Valentine Series

The Valentine series consists of deep, excessively drained, rolling to steep sandy soils on uplands. These soils formed in eolian sand.

In a representative profile the surface layer is grayish-brown fine sand about 2 inches thick. Below this is a transition layer of grayish-brown fine sand about 6 inches thick. The underlying material is pale-brown fine sand.

Valentine soils are low in organic-matter content and fertility. Permeability is rapid, and surface runoff is slow to very slow. Available water capacity is low. Susceptibility to soil blowing is very high.

All areas are in native grass and are used for grazing.

Representative profile of Valentine fine sand, 15 to 35 percent slopes, 1,670 feet south of the northeast corner of sec. 20, T. 40 N., R. 32 W.:

A1—0 to 2 inches, grayish-brown (10YR 5/2) fine sand, very dark grayish brown (10YR 3/2) moist; weak, very fine, granular structure parting to single grained; soft, very friable; neutral; abrupt, smooth boundary.

AC—2 to 8 inches, grayish-brown (10YR 5/2) fine sand, very dark grayish brown (10YR 3/2) crushing to dark grayish brown (10YR 4/2) moist; very weak, medium, prismatic structure parting readily to single grained; loose; neutral; clear, smooth boundary.

C—8 to 60 inches, pale-brown (10YR 6/3) fine sand, dark brown (10YR 4/3) moist; single grained; loose; neutral.

The A horizon ranges from grayish brown to pale brown in hue of 10YR. It is fine sand or loamy fine sand and is 2 to 6 inches thick. The AC horizon is intermediate in color between the A and C horizons. The C horizon ranges from light brownish gray or pale brown to very pale brown in hue of 10YR. In places it has thin, dark-colored layers and is stratified with layers of coarser sand.

Valentine soils are mapped with Dunday soils and are similar to Bankard soils. Compared with Dunday soils, they have thinner horizons that are very dark grayish brown or darker when moist. They are less stratified than the calcareous Bankard soils, which formed in sandy alluvium.

Valentine fine sand, 15 to 35 percent slopes (VaE).—This soil is in areas where several feet of loose sand has been deposited. Some areas have short, convex slopes typical of sandhills and include places that are less sloping. Other areas have steep slopes along drainageways.

Included with this soil in mapping are areas of Dunday soils. Also included in some of the steep areas along drainageways are Conata, Epping, Imlay, Larvie, and Norrest soils, depending on the kind of underlying material.

This Valentine soil is highly susceptible to soil blowing. Surface runoff is slow. All areas are in native grass and are used for grazing (fig. 8). Sands range site; capability unit VIIe–1; windbreak group 10.

Wanblee Series

The Wanblee series consists of moderately deep, moderately well drained, nearly level to gently sloping silty soils that have a claypan subsoil. These soils formed in material weathered from the underlying siltstone. They are on broad flats and foot slopes and along drainageways on uplands.

In a representative profile the surface layer is gray silt loam about 1 inch thick. The subsoil contains sodium and is about 6 inches thick. It is dark-gray silty clay loam in the upper part and calcareous, brown silty clay loam in the lower part. The upper part is extremely hard when dry and very firm when moist. The underlying material to a depth of 20 inches is calcareous, pinkish-gray light silty clay loam. Below this is calcareous, pinkish-gray, light-gray, and white, soft siltstone.

Wanblee soils are low in organic-matter content and fertility. Permeability is slow, and surface runoff is slow. Available water capacity is low.

Almost all the areas are in native grass and are used for grazing.

Representative profile of Wanblee silt loam in an area of Wanblee-Wortman association, 0 to 5 percent slopes, 2,460 feet east and 288 feet north of the southwest corner of sec. 5, T. 40 N., R. 32 W.:

A2—0 to 1 inch, gray (10YR 6/1) silt loam, dark grayish brown (10YR 4/2) crushing to grayish brown (10YR 5/2) moist; weak, fine, platy and granular structure; slightly hard, friable; many very fine pores, mostly blocked; moderately alkaline; abrupt, wavy boundary.

B2t—1 to 3 inches, dark-gray (10YR 4/1) silty clay loam, very dark grayish brown (10YR 3/2) moist; strong, medium and fine, columnar structure parting to moderate, fine, blocky; extremely hard, very firm; gray silt of the A2 horizon caps the columns; thin, continuous clay films; strongly alkaline; abrupt, smooth boundary.

B3—3 to 7 inches, brown (7.5YR 5/2) silty clay loam, dark brown (7.5YR 3/2) crushing to dark brown (7.5YR 4/2) moist; weak, coarse, prismatic structure parting to weak, medium and fine, blocky; very hard, firm; common fine bits and particles of siltstone; violent effervescence; strongly alkaline; clear, smooth boundary.

C1sa—7 to 20 inches, pinkish-gray (7.5YR 7/2) light silty clay loam, brown (7.5YR 5/2) moist; weak, coarse, prismatic structure; slightly hard, firm; common fine bits and fragments of siltstone; few fine threads of segregated lime and other salts; violent effervescence; strongly alkaline; gradual, smooth boundary.

C2—20 to 40 inches, pinkish-gray (7.5YR 6/2), light-gray (7.5YR 7/1), and white (N 8/0), soft siltstone that crushes easily to silt loam, brown (7.5YR 5/2) moist; bedded; breaks out into fine blocky fragments; slightly hard, friable; common fine threads of segregated lime; violent effervescence; strongly alkaline.

Bedded soft siltstone is commonly at a depth of 20 to 40 inches. The A horizon is silt loam, loam, or very fine sandy loam and ranges from less than 1 inch to 4 inches in thickness. The B2t horizon is silty clay loam or silty clay and ranges from 2 to 9 inches in thickness. Segregations of salts commonly are in the B3 horizon, the upper C horizon, or both.

Wanblee soils are mapped with Whitelake and Wortman soils. They have thinner A and B horizons than those soils. They have a more clayey, less sandy B horizon than Whitelake soils. They are similar to Minatare soils, but formed over siltstone, whereas Minatare soils formed in alluvium.

Figure 8.—**Range on Valentine fine sand, 15 to 35 percent slopes.**

Wanblee-Whitelake complex (0 to 6 percent slopes) (Wa).—This mapping unit is about 50 percent Wanblee soil, about 30 percent Whitelake soil, and 20 percent other soils. These soils are mostly on stream terraces and are moderately deep over siltstone. Scattered areas of wind-deposited sand occur throughout the mapped areas. The surface of these areas is uneven. Small mounds rise 1 to 3 feet above the lower parts of the area. The Wanblee soil is in the lower areas. It has a profile similar to the one described as representative of the Wanblee series, but the surface layer is fine sandy loam in places, and the depth over siltstone is more than 40 inches in places. The Whitelake soil is on the mounds. It has the profile described as representative of the Whitelake series.

Included with these soils in mapping are areas of Duroc, Huggins, Kadoka, and Wortman soils. Duroc soils are along some of the drainageways. Huggins and Kadoka soils are on rises. Wortman soils are commonly on low mounds above the Wanblee soils.

Wanblee and Whitelake soils have slow surface runoff. Permeability is very slow in the Wanblee soil. The Wanblee soil, which is not suitable for cultivation, limits the use of this complex.

All areas are in native grass and are used for grazing. Wanblee soil in Thin Claypan range site, capability unit VIs–1, windbreak group 10; Whitelake soil in Sandy range site, capability unit IVe–13, windbreak group 5.

Wanblee-Wortman association, 0 to 5 percent slopes (WbB).—This mapping unit is 50 percent Wanblee soil, 20 to 40 percent Wortman soil, and 10 to 30 percent other soils. These soils have an uneven surface because low mounds rise a few inches above small depressions or low areas. The Wanblee soil is in the low areas or small depressions that range to as much as several feet in diameter. The Wortman soil is on the small mounds or very slight rises. Each of these soils has the profile described as representative of its respective series, but in some areas the depth over siltstone is more than 40 inches.

Included with these soils in mapping are areas of Blackpipe, Buffington, Huggins, Kadoka, Kube, Larvie, Norrest, Ree, Savo, and Tuthill soils. The occurrence of these inclusions varies from one area to another.

Wanblee and Wortman soils have poor tilth and take in water slowly. Surface runoff is slow to moderate. Most areas are not cultivated because the Wanblee soil is not suitable for cultivation.

Almost all the areas are in native grass and are used for grazing. Wanblee soil in Thin Claypan range site, capability unit VIs–1, windbreak group 10; Wortman

soil in Claypan range site, capability unit IVs–3, windbreak group 9.

Whitelake Series

The Whitelake series consists of deep, moderately well drained, nearly level to gently sloping loamy soils on uplands. These soils formed in wind-deposited sandy material.

In a representative profile the surface layer is grayish-brown fine sandy loam about 5 inches thick. Below this is a subsurface layer of light brownish-gray fine sandy loam about 5 inches thick. The upper 6 inches of the subsoil contains sodium and is calcareous, light brownish-gray fine sandy loam that is hard when dry and firm when moist. Below this to a depth of 24 inches is light brownish-gray sandy loam and dark-gray heavy sandy loam. The underlying material is light brownish-gray silty clay loam.

Whitelake soils are medium in organic-matter content and fertility. Permeability is moderately slow to slow, and surface runoff is slow. Available water capacity is medium.

Almost all areas are in native grass and are used for grazing or hay.

The Whitelake soils in Mellette County are mapped only with Tuthill and Wanblee soils.

Representative profile of Whitelake fine sandy loam in an area of Wanblee-Whitelake complex, 45 feet west and 24 feet south of the northeast corner of sec. 35, T. 41 N., R. 33 W.:

A1—0 to 5 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure and weak, fine, platy; soft, very friable; mildly alkaline; clear, smooth boundary.

A2—5 to 10 inches, light brownish-gray (10YR 6/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; slightly hard, very friable; moderately alkaline; abrupt, wavy to irregular boundary.

B2t—10 to 16 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; strong, coarse, prismatic structure parting to weak, coarse and medium, blocky; hard, firm; strong effervescence; strongly alkaline; clear, smooth boundary.

A'2—16 to 18 inches, light brownish-gray (10YR 6/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, prismatic structure parting to weak, fine, platy; hard, firm; strong effervescence; strongly alkaline; abrupt, smooth boundary.

B'2t—18 to 24 inches, dark-gray (10YR 4/1) heavy sandy loam, very dark brown (10YR 2/2) crushing to very dark grayish brown (10YR 3/2) moist; strong, medium and coarse, prismatic structure parting to moderate, coarse, blocky; very hard, very firm; common fine and medium nests of salts; slight effervescence on faces of peds; strongly alkaline; clear, smooth boundary.

IIC—24 to 60 inches, light brownish-gray (10YR 6/2) light silty clay loam, grayish brown (10YR 5/2) moist; massive; hard, firm; strong effervescence; strongly alkaline.

In places there is only one sequence of A and B horizons. The A1 horizon is dark grayish brown in hue of 10YR and is 5 to 11 inches thick. The A2 horizon ranges from gray to light brownish gray in hue of 10YR and is 2 to 5 inches thick. The B2t horizon is fine sandy loam, very fine sandy loam, or loam and is less than 18 percent clay. It is 3 to 8 inches thick. A B3 horizon occurs in some profiles. The C horizon ranges from loamy fine sand to silty clay loam, depending on the thickness of the wind-deposited sandy material. Siltstone or shale is below a depth of 40 inches in most profiles.

Whitelake soils are mapped with Tuthill and Wanblee soils and are near Wortman soils. Their B horizon is less clayey and contains more sodium than that of Tuthill soils. They have a more sandy, less clayey B horizon than Wanblee and Wortman soils.

Woodly Series

The Woodly series consists of deep, moderately well drained, nearly level to gently sloping loamy soils on uplands, in swales, and on foot slopes. These soils formed in alluvium washed in from adjacent soils and in eolian sandy material.

In a representative profile the surface layer is very dark gray and gray fine sandy loam about 21 inches thick. The subsoil, about 29 inches thick, is dark grayish-brown sandy clay loam in the upper part and light olive-brown sandy loam in the lower part. The upper part is extremely hard when dry and very firm when moist. The underlying material is light brownish-gray sandy loam.

Woodly soils are high in organic-matter content and fertility. Permeability is moderate, and surface runoff is slow to moderate. Many areas receive additional moisture in the form of runoff from adjacent soils. Available water capacity is medium to high.

Many areas are in native grass and are used for grazing and hay. Alfalfa, sorghum, and winter wheat are the main crops.

Representative profile of Woodly fine sandy loam in an area of Tuthill-Woodly fine sandy loams, 3 to 6 percent slopes, 660 feet east and 420 feet south of the northwest corner of sec. 15, T. 40 N., R. 29 W.:

A11—0 to 9 inches, very dark gray (10YR 3/1) fine sandy loam, black (10YR 2/1) crushing to very dark brown (10YR 2/2) moist; weak, fine and medium, granular and subangular blocky structure; slightly hard, very friable; neutral; abrupt, smooth boundary.

A12—9 to 17 inches, gray (10YR 5/1) fine sandy loam, very dark brown (10YR 2/2) moist; weak, medium and coarse, prismatic structure parting to weak, fine, subangular blocky; hard, friable; neutral; clear, smooth boundary.

A3—17 to 21 inches, gray (10YR 5/1) heavy fine sandy loam, very dark brown (10YR 2/2) crushing to very dark grayish brown (10YR 3/2) moist; weak, medium and coarse, prismatic structure parting to weak, fine and medium, subangular blocky; hard, friable; neutral; clear, wavy boundary.

B21t—21 to 33 inches, dark grayish-brown (2.5Y 4/2) sandy clay loam, very dark grayish brown (2.5Y 3/2) moist; coatings of dark gray (10YR 4/1) on faces of peds, very dark gray (10YR 3/1) moist; strong, coarse and medium, prismatic structure parting to moderate, medium, blocky; extremely hard, very firm, sticky and plastic; thin, continuous clay films and bridgings; neutral; gradual, smooth boundary.

B22t—33 to 40 inches, dark grayish-brown (2.5Y 4/2) sandy clay loam, dark grayish brown (2.5Y 4/2) and very dark grayish brown (2.5Y 3/2) crushing to olive brown (2.5Y 4/3) moist; moderate, coarse and fine, prismatic structure parting to moderate, fine, blocky; extremely hard, very firm, sticky and plastic; thin, continuous clay films and bridgings; neutral; gradual, smooth boundary.

B3—40 to 50 inches, light olive-brown (2.5Y 5/3) sandy loam, olive brown (2.5Y 4/3) crushing to dark grayish brown (2.5Y 4/2) moist; faces of ped coats grayish brown (2.5Y 5/2); weak, coarse, prismatic structure

parting to weak, coarse, subangular blocky; very hard, firm, slightly sticky; neutral; gradual, smooth boundary.

C—50 to 60 inches, light brownish-gray (2.5Y 6/2) sandy loam, light olive brown (2.5Y 5/3) moist; weak, coarse, prismatic structure; slightly hard, friable; neutral.

The A horizon is commonly fine sandy loam, but is loam or silt loam in some profiles. It ranges from 12 to 24 inches in thickness. The B2t horizon ranges from 14 to 24 inches in thickness. The C horizon is commonly sandy loam, but below a depth of 40 inches it ranges from sand to clay. In some profiles the C horizon contains buried, dark-colored horizons.

Woodly soils are mapped with Tuthill soils and have a thicker A horizon than those soils. They are sandier than Duroc and Keya soils, which are also on foot slopes and in swales on uplands.

Woodly fine sandy loam (0 to 2 percent slopes) (Wd).—This soil is in swales and along drainageways of the uplands.

Included with this soil in mapping are areas of Keya, Ree, Savo, and Tuthill soils. Keya soils are in some of the low areas. Opal, Promise, Ree, Savo, and Tuthill soils are at the edges of the swales.

This Woodly soil is high in fertility. Available water capacity is medium to high. Surface runoff is slow. Controlling soil blowing is the main concern in management.

Alfalfa, winter wheat, and sorghum are the main crops. Some areas are in native grass and are used for grazing or hay. Sandy range site; capability unit IIIe–7; windbreak group 5.

Woodly-Opal complex, 2 to 5 percent slopes (WoB).—This mapping unit is 60 to 70 percent Woodly soil, 20 percent Opal soil, and 10 to 20 percent other soils. These soils are in swales or along drainageways of the uplands. The Woodly soil has a profile similar to the one described as representative of its series, but in places clay or shale is at a depth ranging from 40 to 60 inches. The Opal soil borders areas where eolian sandy material is missing. It has a profile similar to the one described as representative of the Opal series, but in places the surface layer ranges from fine sandy loam to clay loam.

Included with these soils in mapping are areas of Promise, Ree, and Tuthill soils.

Woodly and Opal soils have moderate surface runoff. The Woodly soil is more friable and more permeable than the Opal soil. Controlling water erosion and soil blowing is the main concern in management.

Many areas are in native grass and are used for grazing or hay. Alfalfa, sorghum, and small grain are the main crops. Capability unit IIIe–8; Woodly soil in Sandy range site, windbreak group 5; Opal soil in Clayey range site, windbreak group 4.

Wortman Series

The Wortman series consists of moderately deep, moderately well drained to well drained, nearly level to gently sloping silty soils that have a claypan subsoil. These soils formed in silty material weathered from the underlying soft siltstone. They are on uplands below areas of steeper soils and along drainageways.

In a representative profile the surface layer is brown silt loam about 3 inches thick. The subsurface layer is gray silt loam about 2 inches thick. The subsoil, about 13 inches thick, is silty clay loam that is dark brown in the upper part, brown in the middle part, and pinkish gray in the lower part. It is extremely hard when dry and very firm when moist. The lower part contains sodium and is calcareous. The underlying material to a depth of 36 inches is calcareous, pinkish-gray silty clay loam. Below this is pinkish-gray, soft siltstone.

Wortman soils are medium in organic-matter content and fertility. Permeability is very slow, and surface runoff is slow. Available water capacity is low to medium.

Most areas are in native grass and are used for grazing and hay.

Representative profile of Wortman silt loam in an area of Wanblee-Wortman association, 0 to 5 percent slopes, 2,460 feet east and 300 feet north of the southwest corner of sec. 5, T. 40 N., R. 32 W.:

A1—0 to 3 inches, brown (7.5YR 5/2) silt loam, dark brown (7.5YR 3/2) moist; weak, fine, platy and granular structure; slightly hard, friable; neutral; abrupt, smooth boundary.

A2—3 to 5 inches, gray (7.5YR 5/1) silt loam, dark brown (7.5YR 3/2) moist; weak, coarse, blocky structure; hard, friable; many very fine open pores; mildly alkaline; abrupt, smooth boundary.

B21t—5 to 7 inches, dark-brown (7.5YR 4/2) heavy silty clay loam, dark brown (7.5YR 3/2) moist; strong, medium, columnar structure; extremely hard, very firm; pinkish-gray silty caps on tops of columns; thin, continuous clay films; moderately alkaline; abrupt, smooth boundary.

B22t—7 to 11 inches, brown (7.5YR 5/2) silty clay loam, dark brown (7.5YR 4/2) moist; moderate, medium, prismatic structure parting to moderate, medium, blocky; extremely hard, very firm; thin, continuous clay films; strongly alkaline; clear, smooth boundary.

B3—11 to 18 inches, pinkish-gray (7.5YR 6/2) light silty clay loam streaked with dark gray (7.5YR 4/1), brown (7.5YR 5/2), and dark brown (7.5YR 4/2) moist; moderate, medium and coarse, prismatic structure parting to moderate, medium, blocky; very hard, very firm; thin, patchy clay films; strong effervescence; strongly alkaline; gradual, smooth boundary.

C1—18 to 36 inches, pinkish-gray (7.5YR 7/2) light silty clay loam, pinkish gray (7.5YR 6/2) moist; weak, coarse, prismatic structure; very hard, friable; animal burrow at 30 inches filled with darker colored material; strong effervescence; moderately alkaline; gradual, smooth boundary.

C2—36 to 60 inches, pinkish-gray (7.5YR 7/2), soft siltstone that crushes easily to silt loam, pinkish gray (7.5YR 6/2) moist; bedded; hard, friable; siltstone can be dug easily with a spade; strong effervescence; moderately alkaline.

Depth to siltstone ranges from 20 to 40 inches. The A1 horizon ranges from dark gray to grayish brown in hue of 10YR. It is silt loam, loam, or very fine sandy loam and is 3 to 6 inches thick. The A2 horizon is gray or light brownish gray in hue of 10YR and is 1 to 3 inches thick. The B2t horizon is silty clay loam or silty clay and ranges from 4 to 12 inches in thickness. The B3 and C1 horizons commonly contain segregations of salts.

Wortman soils are mapped with Wanblee soils and have thicker A and B horizons than those soils. They have more sodium in the B horizons than the nearby Huggins and Kadoka soils.

Wortman and Wanblee silt loams (0 to 6 percent slopes) (Ww).—This mapping unit consists of Wortman and Wanblee soils in proportions that differ from one area to another. The Wortman soil is generally dominant, but in some areas the Wanblee soil is dominant. The Wanblee soil is in low areas or very small depres-

sions where the uneven surface is more pronounced. Each of these soils has a profile similar to the one described as representative of its respective series, but in some areas the depth over siltstone is more than 40 inches.

Included with these soils in mapping are areas of Blackpipe, Haverson, Huggins, Kadoka, Keya, Larvie, Norrest, Ree, and Savo soils. Any one or more of these are in a given area, depending on the soils in adjacent areas. Inclusions make up 10 to as much as 40 percent of a given mapped area.

Wortman and Wanblee soils generally have poor tilth and take in water slowly. Surface runoff is slow to moderate. Improving tilth and water intake as well as controlling water erosion and soil blowing are concerns in management. Most areas are in native grass and are used for grazing. Wortman soil in Claypan range site, capability unit IVs–3, windbreak group 9; Wanblee soil in Thin Claypan range site, capability unit VIs–1, windbreak group 10.

Use and Management of the Soils

The soils of Mellette County are used mainly as range. This section contains information on range management, a table of estimated yields of the principal crops, information on the suitability of the soils for windbreaks, and general suggestions for the improvement of wildlife habitat. Data from engineering tests and interpretations of soil properties that affect highway construction and other engineering structures are shown in tables 5, 6, and 7.

The capability grouping used by the Soil Conservation Service is explained, and the capability units in the survey area are defined and their management is discussed.

Range [3]

Almost all of Mellette County was originally grassland. Ponderosa pines, growing singly or in clumps, are on some escarpments and on slopes of deeply dissected drainageways in and near areas of Badland, and deciduous trees and shrubs are on some of the bottom land and along some of the upland drainageways.

This county is in a broad transitional area between the higher moisture regime of the true prairie to the east and the drier plains of the mixed prairie to the west. The original vegetation was dominantly mid grasses in most of the upland areas, but was dominantly tall grasses in the areas that had favorable moisture regimes. Short grasses are more evident on sites where the moisture regime is less favorable than is typical. Both warm-season and cool-season grasses are present. The warm-season grasses are dominant on shallow soils and in the more sandy parts of the county (*8*).

About 82 percent of the county is range or pasture. Native grass for pasture and hay is a major crop. It furnishes grazing throughout much of the year and provides feed for breeding herds during periods of snow cover. Livestock enterprises are mainly beef cattle, but include some dairy cattle, as well as sheep and horses.

[3] By C. M. SCHUMACHER, range conservationist, Soil Conservation Service.

Range sites and condition classes

A range site is a distinctive kind of range that has a particular potential for the production of native plants, both in the kind and proportion of plants and in the total annual yield. Each range site supports a plant community that differs from that produced on other sites if no abnormal disturbance and physical deterioration have occurred.

Range condition is the present state of vegetation in relation to the climax, or original, vegetation of that site. Range condition classes represent the degree to which the present composition, expressed in percent, differs from that of the climax vegetation of a range site.

Four range condition classes are recognized: excellent, good, fair, and poor. A range is in *excellent* condition if 76 to 100 percent of the vegetation is climax vegetation of that site. It is in *good* condition if the percentage is 51 through 75, in *fair* condition if the percentage is 26 through 50, and in *poor* condition if the percentage is 25 or less.

Range condition provides a measure of the change that has taken place in the plant cover and a basis for predicting changes that can be expected in the plant community under different levels of management.

Range plants are classified as decreasers, increasers, and invaders, according to their response to grazing on a specific site. Decreasers are those species in the climax vegetation that decrease in number if the site is subject to continuous close grazing. Increasers are those plants in the climax vegetation that become more abundant as the decreasers decline. Invaders are plants that are not part of the potential plant community, but that invade the site and become established if the climax vegetation is depleted.

Descriptions of range sites

The soils of Mellette County are grouped in 12 range sites, which are described in the following paragraphs. Each description gives the important soil characteristics, the principal plants, and estimates of total annual air-dry yield. The estimates are based on plot clippings taken from range in excellent condition. Grasses that provide the major source of forage for cattle make up 70 to 90 percent of the total yield on all sites in excellent condition.

The names of the soil series represented in each site are also given in the site description, but this does not mean that all the soils in a given series are in that site. To find the range site of a specific soil and the page on which it is described, turn to the "Guide to Mapping Units."

OVERFLOW RANGE SITE

This site consists of deep, moderately well drained and well drained loamy to clayey soils of the Buffington, Glenberg, Haverson, Keya, Promise, and Stirk series. These soils are in upland swales and on bottom land. They receive varying amounts of additional moisture as stream overflow and as runoff from adjacent soils. The additional moisture and a favorable soil-water relationship on this site increase its potential for producing good stands of tall and mid grasses. The potential forage yield is higher on soils of this site than on similar soils on uplands.

The climax plant cover is a mixture of tall and mid grasses. Big bluestem is the most important decreaser. Other decreasers are green needlegrass, indiangrass, and switchgrass. Western wheatgrass is a prominent increaser on Buffington and Stirk soils and is the most abundant species on the Stirk soil. Other increasers are needle-and-thread and side-oats grama. Scattered trees and shrubs, and clumps and stringers of these along stream channels, provide cover and forage for wildlife.

Under heavy grazing, or overuse, the proportion of western wheatgrass increases. Under continued overuse, Kentucky bluegrass, buffalograss, and weedy plants, such as blue vervain, become more abundant.

Areas used for hay can be mowed annually if mowing is done at the proper time and crop aftermath is protected.

When this site is in excellent condition, the estimated total annual production ranges from 2,600 pounds per acre in unfavorable years to 3,900 pounds per acre in favorable years.

CLOSED DEPRESSION RANGE SITE

Kolls and Hoven soils, the only mapping unit in this site, is poorly drained. Surface water ponds and remains until it evaporates. Permeability is very slow. Because this site is subject to alternate wet and dry periods, the potential plant cover does not have the stability normally associated with climax vegetation.

When this site is in excellent condition, western wheatgrass is dominant. Big bluestem and switchgrass and the increasers blue grama, buffalograss, and inland saltgrass are present in small amounts. Sedges, rushes, and forbs, such as smartweed, are more abundant during wet periods.

Overuse and trampling by livestock adversely affect drainage, and weeds and buffalograss become more abundant.

Mechanical measures, such as furrowing and pitting, are not feasible.

When this site is in excellent condition, the estimated total annual production ranges from 2,300 pounds per acre in unfavorable years to 3,500 pounds per acre in favorable years.

SANDS RANGE SITE

This site consists of Sandy land and deep, loose sandy soils of the Bankard, Dunday, and Valentine series. These soils readily absorb precipitation, but have low available water capacity.

The climax vegetation is mainly a mixture of warm-season grasses. Sand bluestem, little bluestem, indiangrass, and switchgrass are the main decreasers. Prairie sandreed, the principal increaser, commonly becomes the dominant grass. Woody plants, such as leadplant, rose, and sand cherry, are an important part of the plant community. Scattered trees are growing in areas of the Bankard soil.

Under heavy grazing, or overuse, prairie sandreed replaces sand bluestem and little bluestem. Under continued overuse, bare areas are common and soil blowing is a serious hazard.

This site responds quickly to deferred grazing or season-long rest. Mechanical measures, such as contour furrowing and pitting, are not feasible.

When this site is in excellent condition, the estimated total annual production ranges from 2,100 pounds per acre in an unfavorable year to 2,700 pounds per acre in a favorable year.

SANDY RANGE SITE

This site consists of deep, well drained and moderately well drained loamy soils of the Anselmo, Glenberg, Manter, Tuthill, Whitelake, and Woodly series. These soils are on uplands and terraces. They formed in sandy material. Permeability is moderately slow to slow in the Whitelake soil, which has a claypan subsoil, and moderate to moderately rapid in the rest. All but the Whitelake soil have a soil-water relationship that favors the development of plant roots.

The climax plant cover is mainly a mixture of mid and tall warm-season grasses, chiefly little bluestem and big bluestem. Also present in small amounts are cool-season decreasers, such as Canada wildrye and prairie junegrass. The main increasers are prairie sandreed, needle-and-thread, and western wheatgrass. Blue grama and side-oats grama are present in small amounts.

Under heavy grazing, or overuse, little bluestem and big bluestem are replaced by prairie sandreed, needle-and-thread, and western wheatgrass. Under continued overuse, sand dropseed, threadleaf sedge, and blue grama become dominant.

When this site is in excellent condition, the estimated total annual production ranges from 1,950 pounds per acre in an unfavorable year to 2,600 pounds per acre in a favorable year.

SILTY RANGE SITE

This site consists of moderately deep and deep loamy and silty soils of the Altvan, Blackpipe, Buffington, Caputa, Duroc, Haverson, Huggins, Kadoka, Keya, Kube, Lowry, Ree, Reliance, and Savo series. These soils have moderate to moderately slow permeability. Available water capacity is low in Altvan and Huggins soils and medium to high in the rest.

The climax plant cover is mainly green needlegrass and the cool-season increasers western wheatgrass and needle-and-thread. Also present are small amounts of blue grama and side-oats grama, as well as a trace of leadplant, an important browse plant (fig. 9).

Under heavy grazing, or overuse, western wheatgrass and needle-and-thread increase. Under continued overuse, these grasses are replaced by blue grama and by forbs, such as gray sagewort.

When this site is in excellent condition, the estimated total annual production ranges from 1,800 pounds per acre in an unfavorable year to 2,600 pounds per acre in a favorable year.

CLAYEY RANGE SITE

This site consists of moderately deep and deep silty to clayey soils of the Buffington, Kyle, Lakoma, Larvie, Metre, Millboro, Norrest, Okreek, Opal, and Promise series. All but Norrest soils have a clayey subsoil. Permeability is moderately slow to very slow. Available water capacity is high in Buffington soils and low to medium in the rest.

The climax plant cover is mainly a mixture of green needlegrass and western wheatgrass and an understory of blue grama and buffalograss. Forbs and woody plants are scarce.

Figure 9.—**Silty range site. The mapping unit is Ree and Keya loams, 2 to 5 percent slopes.**

Under heavy grazing, or overuse, green needlegrass is replaced by western wheatgrass. Under continued overuse, western wheatgrass is replaced by buffalograss and blue grama.

When this site is in excellent condition, the estimated total annual production ranges from 1,500 pounds per acre in an unfavorable year to 2,400 pounds per acre in a favorable year.

THIN UPLAND RANGE SITE

This site consists of moderately deep and deep, calcareous silty soils of the Keota and Mitchell series. These soils are low in organic-matter content and in fertility. Permeability is moderate.

The climax plant cover is a mixture of cool- and warm-season grasses, chiefly needle-and-thread, green needlegrass, and western wheatgrass, and the warm-season grasses little bluestem, plains muhly, and side-oats grama. Blue grama is present in the understory. Forbs, such as dotted gayfeather, and shrubs, such as leadplant, are common.

Under heavy grazing, or overuse, needle-and-thread increases. Under continued overuse, blue grama and threadleaf sedge become the major species.

When this site is in excellent condition, the estimated total annual production ranges from 1,500 pounds per acre in an unfavorable year to 2,100 pounds per acre in a favorable year.

SHALLOW RANGE SITE

This site consists of shallow clayey and silty soils of the Conata, Epping, Imlay, Orella, and Samsil series. These soils are on uplands and are less than 20 inches deep over shale, mudstone, or siltstone. Bedrock restricts the movement of water and the development of roots. Surface runoff is rapid. Available water capacity is low or very low.

The climax plant cover is dominated by little bluestem. Western wheatgrass and green needlegrass also are present. Side-oats grama, needle-and-thread, and blue grama or hairy grama are the principal increasers. Forbs and shrubs commonly present are black sampson, prairie clover, skunkbush sumac, leadplant, and rose.

Under heavy grazing, or overuse, little bluestem is replaced by the increasers. Continued overuse leaves a large part of the site bare of vegetation and increases the erosion hazard.

When this site is in excellent condition, the estimated total annual production ranges from 1,300 pounds per acre in an unfavorable year to 1,900 pounds per acre in a favorable year.

CLAYPAN RANGE SITE

This site consists of moderately deep and deep soils of the Cedar Butte, Mosher, and Wortman series. These soils have a silty surface layer over a dense claypan subsoil that restricts the movement of water, air, and plant roots. Available water capacity is low to medium.

The climax plant cover is a mixture of mid and short grasses consisting of western wheatgrass, needle-and-thread, blue grama, buffalograss, and sedges. Forbs and woody plants are scarce.

Under heavy grazing, or overuse, the mid grasses are replaced by blue grama and buffalograss. Continued overuse leaves a large part of the site bare of vegetation, especially during dry cycles.

When this site is in excellent condition, the estimated total annual production ranges from 1,100 pounds per acre in an unfavorable year to 1,800 pounds per acre in a favorable year.

THIN CLAYPAN RANGE SITE

This site consists of Slickspots and moderately deep and deep soils of the Hisle, Minatare, and Wanblee series. These soils have a very thin silty surface layer over a dense claypan subsoil. They are commonly strongly alkaline in the subsoil, and in places accumulations of salts are evident in the lower part of the subsoil. Available water capacity ranges from very low to medium. Permeability is slow to very slow. The claypan restricts root growth.

The climax plant cover is a mixture of mid and short grasses. Western wheatgrass is the main decreaser, and blue grama is the main increaser. Pricklypear cactus is present in small amounts.

Under heavy grazing, or overuse, the mid grasses are replaced by blue grama, buffalograss, and inland saltgrass. Continued overuse leaves only pricklypear cactus, and much of the site bare of vegetation.

When this site is in excellent condition, the estimated total annual production ranges from 600 pounds per acre in an unfavorable year to 1,200 pounds per acre in a favorable year.

SHALLOW TO GRAVEL RANGE SITE

This site consists of gravelly soils of the Murdo series. These soils have a gravelly loam or loam surface layer and a gravelly clay loam subsoil. They are only 10 to 20 inches deep over sand and gravel. Permeability is moderately rapid in the surface layer and subsoil and rapid in the sand and gravel. Available water capacity is low.

The climax plant cover is a mixture of mid and short grasses, consisting of needle-and-thread, blue grama, hairy grama, and threadleaf sedge. Forbs, such as dotted gayfeather and gray sagewort, commonly are present.

Under heavy grazing, or overuse, short grasses and forbs are dominant. Continued overuse thins out the grass and leaves bare spots.

Mechanical measures, such as contour furrowing and pitting, are not feasible on this soil.

When this site is in excellent condition, the estimated total annual production ranges from 1,200 pounds per acre in an unfavorable year to 1,750 pounds per acre in a favorable year.

VERY SHALLOW RANGE SITE

This site consists of gravelly soils of the Schamber series. Gravel and sand are within a depth of 10 inches. Available water capacity is very low.

Climax plant cover is a mixture of mid and short grasses, consisting mainly of needle-and-thread, blue grama, hairy grama, and threadleaf sedge. Also commonly present is the legume, bigtop dalea.

Under heavy grazing, or overuse, the site rapidly deteriorates to a stand of blue grama, hairy grama, threadleaf sedge, and unpalatable forbs (fig. 10). Continued overuse thins out the stand and leaves much of the site bare of vegetation.

Mechanical measures for range improvement are not feasible. Even where slopes permit, the chance of successful range seeding is very poor.

When this site is in excellent condition the estimated total annual production ranges from 600 pounds per acre in an unfavorable year to 1,200 pounds per acre in a favorable year.

Range management

Range is an important resource in Mellette County. Its management is the key to soil and water conservation in the county. Controlling erosion and conserving moisture are management needs that, if met, also help sustain forage yields.

Proper use of range is basic in meeting these management objectives. In order to manage range properly, it is essential that the rancher understand how the capabilities and limitations of each range site on his ranch determine the kinds and quantity of forage the site can be expected to produce. Forage production also depends on soil moisture. Because rainfall varies widely from one year to another in Mellette County, flexibility in stocking numbers is desirable in range management.

Additional information about range management can be obtained from the local office of the Soil Conservation Service and the County Extension Service.

General Management of Cropland [4]

About 15 percent of Mellette County is cropland. Winter wheat is the main cash crop. Sorghum, spring-sown small grain, corn, and alfalfa are grown as livestock feed. The two most common cropping systems are winter wheat alternated with a year of fallow, and row crops alternated with spring-sown small grain.

The main management practices needed are those that are designed to conserve moisture, to control water erosion and soil blowing, and to maintain or improve tilth, organic-matter content, and fertility.

Moisture can be conserved by reducing evaporation, by limiting surface runoff, by increasing the intake of moisture, and by controlling weeds. Practices that help achieve these goals are stubble mulching, crop residue management, contour farming, contour stripcropping, terracing, field windbreaks, minimum tillage, and chiseling or subsoiling. Timely tillage helps maintain tilth on clayey soils such as Opal, Promise, and Millboro soils. Fallow helps to control weeds and to store moisture if it is used in a crop rotation with winter wheat.

Many of these practices are also effective means of controlling water erosion and soil blowing. Grass cover on natural drainageways helps prevent the formation of gullies. Wind stripcropping and cover crops help control

[4] By WALTER N. PARMETER, conservation agronomist, Soil Conservation Service.

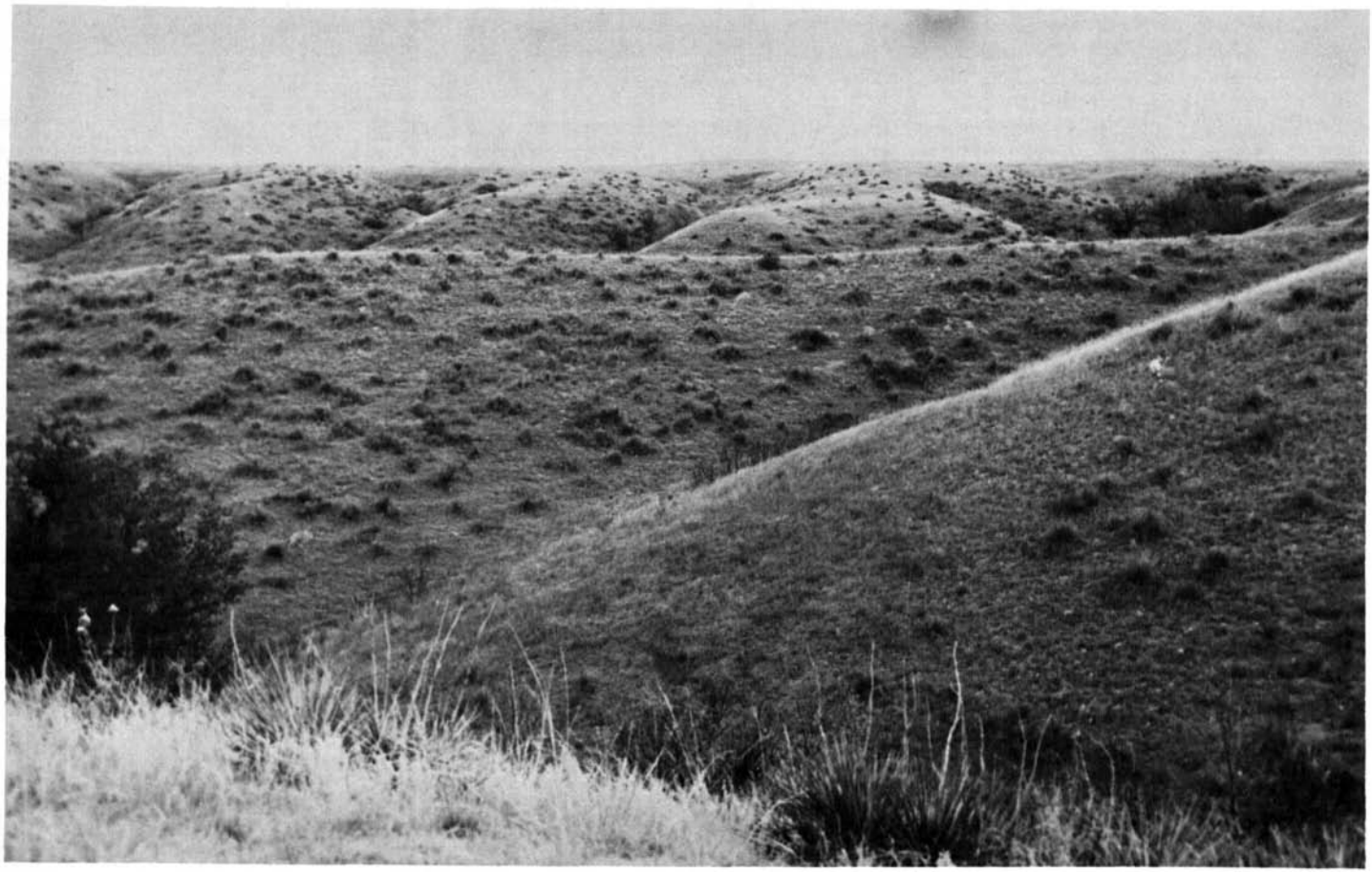

Figure 10.—Very Shallow range site in area of Schamber-Samsil complex, 15 to 40 percent slopes.

soil blowing. Emergency tillage roughens the surface and temporarily reduces soil blowing until more lasting measures can be put into effect.

Applications of chemical fertilizers are needed on many soils in Mellette County. Soils that have been continuously cultivated for many years show some evidence of a nitrogen deficiency. Calcareous soils, such as the Mitchell soils, are likely to be low in available nitrogen and phosphorus.

Capability Grouping

Capability grouping (*2*) shows in a general way the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, the kinds of soil are grouped at three levels, the capability class, the subclass, and the unit. These levels are described in the following paragraphs.

Capability Classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use. (None in Mellette County)

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture or range, woodland, or wildlife.

Class VI soils have severe limitations that make them generally unsuitable for cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuitable for cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial crop production and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture or range, woodland, wildlife habitat, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–1 or IIIs–3. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

Management by capability units

In the following pages each of the capability units in Mellette County is described, and suggestions for the use and management of the soils in each unit are given. The capability units are not numbered consecutively because not all of the units in the statewide system are used in this county.

The names of the soil series in each unit are mentioned in the description, but this does not mean that all the soils in a given series are in that unit. Also, a soil that is part of a soil complex may be assigned to a different capability unit from the one it is assigned to if it is mapped alone. Ordinarily, a complex of soils is treated as a whole in crop management. However, if two soils in a soil complex differ greatly, the capability units are designated for both soils. To find the capability unit for each soil, refer to the "Guide to Mapping Units" at the back of this survey, just ahead of the soil maps.

CAPABILITY UNIT IIe–1

This unit consists of moderately deep and deep, nearly level to gently sloping loamy and silty soils of the Caputa, Duroc, Kadoka, Keya, Lowry, Ree, and Savo series. The surface layer of these soils is loam or silt loam. The subsoil is silt loam in Lowry soils and clay loam or silty clay loam in the rest. In some cultivated areas these soils are slightly eroded.

Surface runoff is moderate. Organic-matter content is medium to high. Fertility is medium to low in the Lowry soils and medium to high in the rest. Available water capacity is medium to low in the Kadoka soils and medium to high in the rest.

Controlling water erosion and soil blowing and conserving moisture are the main concerns in management. Soil blowing is a more serious hazard on Lowry soils than on the other soils.

Winter wheat, sorghum, and alfalfa are the main crops. Corn, barley, oats, rye, and tame grasses also are suitable.

Stubble mulching, crop residue management, and green-manure crops help meet management needs. Wind stripcropping and field windbreaks help control soil blowing. Terraces or contour stripcropping are desirable on some of the longer slopes.

CAPABILITY UNIT IIe–1

This unit consists of deep, nearly level silty soils of the Haverson series. The surface layer of these soils ranges from very fine sandy loam to silty clay loam. It overlies thin layers of silt, sand, and clay.

Fertility is low, and organic-matter content is moderately low to low. Surface runoff is slow. Available water capacity is high.

Conserving moisture and improving the organic-matter content and fertility are the main concerns in management. Some areas are subject to stream overflow, but damage usually is minor.

Alfalfa, sorghum, and corn are the main crops. Some small grain and tame grasses also are grown. Alfalfa and corn are the main crops grown under irrigation.

Crop residue management, use of green-manure crops and animal manure, and commercial fertilizer help meet management needs.

CAPABILITY UNIT IIe–2

This unit consists of moderately deep and deep, nearly level silty and loamy soils of the Blackpipe, Buffington, Duroc, Kadoka, Keya, Kube, Ree, and Savo series. These soils have a surface layer of loam, silt loam, or silty clay loam. The subsoil is commonly clay loam or silty clay loam.

These soils are easy to work. Organic-matter content and fertility are medium to high. Permeability is moderate to moderately slow. Surface runoff is slow. Available water capacity is medium to low in Blackpipe and Kadoka soils and medium to high in the rest.

Conserving moisture is the main concern in management. Controlling soil blowing is a secondary concern in some areas.

Small grain, sorghum. corn, alfalfa, and tame grasses are suitable crops. Winter wheat and sorghum are the main crops. Most of the winter wheat is grown in sequence with summer fallow.

Stubble mulching (fig. 11) or crop residue management helps conserve moisture. Wind stripcropping and field windbreaks, in addition to stubble mulching and crop residue management, help control soil blowing. Contour farming is desirable on long slopes.

CAPABILITY UNIT IIIe-1

Deep, sloping loamy and silty soils of the Caputa and Savo series are in this unit. The surface layer is loam or silt loam, and the subsoil is typically clay loam or silty clay loam. In cultivated areas these soils are slightly to moderately eroded.

Organic-matter content and fertility are medium in all but the eroded areas. Permeability is moderately slow, and available water capacity is high. Surface runoff is moderate.

Controlling erosion is a serious concern in management.

Winter wheat, sorghum, and alfalfa are the main crops. Small grain, corn, and tame grasses also are suitable.

Stubble mulching and contour stripcropping or crop residue management and terracing help meet management needs. Crop residue management alone holds soil losses to acceptable limits if tame grasses and legumes are grown about half the time.

CAPABILITY UNIT IIIe-4

This unit consists of moderately deep and deep, gently sloping clayey soils of the Kyle, Larvie, Metre, Millboro, Opal, and Promise series. These soils have a clay or silty clay surface layer and a clay subsoil. Also in this unit are deep loamy and silty soils of the Caputa, Mosher, Reliance, and Tuthill series. Caputa, Mosher, and Tuthill soils are mapped with Opal soils, and Reliance soils are mapped with Millboro soils. In many cultivated areas the soils in this unit are slightly eroded.

The dominantly clayey soils have poor tilth if cultivated, and they take in water slowly. Surface runoff is moderate. Available water capacity ranges from medium to very low. Organic-matter content is medium to moderately low, and fertility is medium to low.

Controlling water erosion and soil blowing is the main concern in management, but conserving moisture and improving tilth and water intake also are important.

Winter wheat, sorghum, and alfalfa are the main crops. Spring-sown small grain and tame grasses are also suitable. Corn is grown in the eastern part of the county.

Stubble mulching, crop residue management, chiseling or subsoiling, and wind stripcropping, along with the use of green-manure crops, help meet the management needs of these soils. Terracing or contour stripcropping

Figure 11.—**Stubble mulching in an area of Kadoka-Kube silt loams.**

is needed for erosion control on the longer slopes unless grasses and legumes are grown in the crop rotation. Grass cover in natural drainageways helps prevent the formation of gullies.

CAPABILITY UNIT IIIe-5

Mitchell silt loam, the only soil in this unit, is a deep, nearly level, calcareous soil on stream terraces. Both the surface layer and the subsoil are silt loam.

This soil is easy to work, but is high in lime content. It blows easily if cultivated. Organic-matter content and fertility are low.

Controlling soil blowing is the main concern in management. Conserving moisture and improving organic-matter content and fertility also are important.

Winter wheat, corn, sorghum, and alfalfa are the main crops. Alfalfa and corn generally are grown under irrigation. Spring-sown small grain and tame grasses are also suitable.

Crop residue management, stubble mulching, green-manure crops, and grasses and legumes in the cropping system help meet management needs. Wind stripcropping helps control soil blowing in the larger cultivated tracts. Use of commercial fertilizer is important in irrigated areas.

CAPABILITY UNIT IIIe-7

This unit consists of deep, nearly level loamy soils of the Glenberg, Tuthill, and Woodly series. The surface layer of these soils is fine sandy loam. It overlies very fine sandy loam, fine sandy loam, or sandy clay loam.

The loamy soils are easy to work and take in water readily. Available water capacity is medium to high. Organic-matter content and fertility are low in the Glenberg soils and medium to high in the Tuthill and Woodly soils.

Controlling soil blowing is the main concern in management. Improving organic-matter content and fertility is important in the Glenberg soils.

Winter wheat, sorghum, corn, and alfalfa are the main crops. Spring-sown small grain and tame grasses also are suitable.

Wind stripcropping, stubble mulching or crop residue management, and green-manure crops help meet management needs. Field windbreaks help control soil blowing and conserve moisture.

CAPABILITY UNIT IIIe-8

This unit consists of deep, gently sloping or gently undulating loamy soils of the Anselmo, Tuthill, and Woodly series. These soils have a surface layer of fine sandy loam and a subsoil of fine sandy loam or sandy clay loam. Also in this unit are moderately deep clayey soils of the Opal series that are mapped with Woodly soils. In some cultivated areas they are slightly to moderately eroded.

These soils are easy to work and take in water readily. Surface runoff is slow to moderate. The organic-matter content and fertility are medium to high. Available water capacity is medium to low in Anselmo soils. Tuthill and Woodly soils have medium to high available water capacity.

Controlling water erosion and soil blowing is the main concern in management.

Winter wheat, sorghum, corn, and alfalfa are the main crops. Spring-sown small grain and tame grasses also are suitable.

Contour stripcropping or wind stripcropping, stubble mulching or crop residue management, and the use of green-manure crops help meet management needs. Field windbreaks help control soil blowing and conserve moisture.

CAPABILITY UNIT IIIe-12

This unit consists of moderately deep, gently sloping silty soils of the Huggins and Norrest series. These soils have a silt loam surface layer and a silty clay loam subsoil. They are only 20 to 40 inches deep over siltstone. In many cultivated areas they are slightly eroded. Also in this unit are deep silty and clayey soils of the Blackpipe, Kadoka, and Okreek series. Blackpipe and Okreek soils are mapped with Norrest soils, and Kadoka soils are mapped with Huggins soils.

Huggins and Norrest soils have low available water capacity and are somewhat droughty. They are easy to work, but a plowpan forms in the subsoil. Surface runoff is moderate. Organic-matter content is medium to moderately low. Fertility is medium to low.

The main concern in management is controlling erosion. Also important are controlling soil blowing, conserving moisture, and improving water intake.

Winter wheat, sorghum, and alfalfa are the main crops. Spring-sown small grain and tame grasses also are suitable. The underlying siltstone restricts deep-rooted crops, such as corn and alfalfa.

Contour stripcropping and stubble mulching or crop residue management help meet management needs. Green-manure crops improve organic-matter content and fertility, especially in the Norrest soils. Chiseling and subsoiling improve the intake of water.

CAPABILITY UNIT IIIs-3

This unit consists of deep, nearly level clayey soils of the Buffington and Promise series. These soils have a clay or silty clay surface layer. Also in this unit are claypan soils of the Mosher and Opal series that are mapped with Promise soils.

These soils are difficult to work, and they take in water slowly. Organic-matter content and fertility are medium. Surface runoff is slow.

Improving tilth and water intake is the main concern in management. Controlling soil blowing also is important.

Winter wheat, sorghum, corn, and alfalfa are the main crops. Spring-sown small grain and tame grasses also are suitable.

Stubble mulching, crop residue management, chiseling and subsoiling, wind stripcropping, and green-manure crops help meet management needs.

CAPABILITY UNIT IIIs-5

This unit consists of moderately deep, nearly level silty soils of the Huggins and Norrest series. These soils have a silt loam surface layer and a subsoil of silty clay loam. They are only 20 to 40 inches deep over siltstone. Also in this unit are deep silty soils of the Blackpipe and Kadoka series. Blackpipe soils are mapped with Norrest soils, and Kadoka soils are mapped with Huggins soils.

Huggins and Norrest soils have low to medium available water capacity and are somewhat droughty. They are easy to work, but the subsoil compacts readily and forms a plowpan. Organic-matter content is medium to moderately low, and fertility is medium to low.

Improving tilth and water intake is the major concern in management. Controlling soil blowing and maintaining or improving organic-matter content and fertility also are important.

Winter wheat, sorghum, and alfalfa are the main crops. Spring-sown small grain and tame grasses also are suitable. The siltstone restricts the deep roots of such crops as corn and alfalfa. Stubble mulching, crop residue management, chiseling and subsoiling, wind stripcropping, and green-manure crops help meet management needs.

CAPABILITY UNIT IVe-3

This unit consists of moderately deep, sloping silty soils of the Huggins and Norrest series. These soils have a silt loam surface layer and a subsoil of silty clay loam. They are only 20 to 40 inches deep over siltstone. In cultivated areas they are slightly to moderately eroded. Also in this unit are claypan soils of the Cedar Butte series that are mapped with Norrest soils.

These soils have low to medium available water capacity and are somewhat droughty. They are easy to work, but their subsoil compacts readily and forms a plowpan. Surface runoff is moderate. Controlling erosion is the major concern in management. Also important are controlling soil blowing, conserving moisture, improving water intake and tilth, and maintaining the organic-matter content and fertility.

Winter wheat and sorghum are the main crops. Spring-sown small grain, alfalfa. and tame grasses also are suitable. The siltstone restricts the deep roots of such crops as corn and alfalfa.

Contour stripcropping or contour farming along with stubble mulching or crop residue management helps meet management needs. Grasses and legumes and chiseling or subsoiling are beneficial. Terracing is restricted by the underlying siltstone.

CAPABILITY UNIT IVe-4

This unit consists of moderately deep and deep, sloping clayey soils of the Larvie, Millboro, and Opal series. These soils have a clay or silty clay surface layer and a clay subsoil. They are slightly to moderately eroded in cultivated areas. Also in this unit are deep loamy and silty soils of the Caputa, Reliance, and Woodly series. Caputa and Woodly soils are mapped with Opal soils, and Reliance soils are mapped with Millboro soils.

The dominantly clayey soils are difficult to work, and they take in water slowly. Available water capacity ranges from medium to very low, depending on the depth over shale. Surface runoff is moderate. Tilth deteriorates in cultivated areas.

Controlling water erosion and soil blowing is the main concern in management. Conserving moisture, the organic-matter content, and fertility is also important.

Winter wheat, sorghum, and alfalfa are the main crops. Spring-sown small grain, corn, and tame grasses also are suitable.

Stubble mulching, crop residue management, contour stripcropping, terracing, chiseling and subsoiling, and growing grasses and legumes help meet management needs. Two or more of these practices are generally needed to hold soil losses to an acceptable level. Grass waterways help prevent gullying.

CAPABILITY UNIT IVe-5

Altvan loam, 5 to 9 percent slopes, is the only soil in this unit. It has a loam surface layer and a clay loam subsoil and is less than 40 inches deep over sand and gravel. In cultivated areas it is slightly to moderately eroded.

This soil has low available water capacity and is somewhat droughty. It is easy to work, and it takes in water readily. Surface runoff is moderate.

Controlling water erosion and conserving moisture are the main concerns in management. Controlling soil blowing and maintaining the organic-matter content and fertility are additional management needs.

This soil is better suited to early maturing varieties of small grain and sorghum than corn and alfalfa. Sorghum, small grain, and alfalfa are the main crops.

Contour farming or contour stripcropping, along with stubble mulching or crop residue management, help meet management needs. For erosion control, slopes that are too irregular for contouring can be planted to grasses and legumes. The moderate depth of this soil over sand and gravel limits the use of terraces.

CAPABILITY UNIT IVe-8

This unit consists of deep, sloping and undulating loamy soils of the Manter and Tuthill series. These soils have a surface layer of fine sandy loam and a subsoil of sandy loam or sandy clay loam. In some cultivated areas they are slightly to moderately eroded. Also in this unit are moderately deep clayey soils of the Opal series that are mapped with Tuthill soils.

Manter and Tuthill soils are easy to work and take in water readily. Available water capacity is medium to low. Surface runoff is moderate.

Controlling water erosion and soil blowing is the main concern in management. Conserving moisture and maintaining the organic-matter content and fertility are also important.

Sorghum, small grain, and alfalfa are the main crops. Most areas are in native grass.

Contour stripcropping, wind stripcropping, stubble mulching or crop residue management, green-manure crops, and particularly grass and legume crops, are needed for control of both water erosion and soil blowing. These practices also help conserve moisture and maintain fertility and organic-matter content.

CAPABILITY UNIT IVe-13

This unit consists of deep, nearly level to gently sloping loamy soils of the Whitelake series. These soils have a surface layer and a subsoil of fine sandy loam.

These soils are easy to work. Permeability is moderately slow in the subsoil. Surface runoff is slow, and available water capacity is medium.

Controlling soil blowing and improving water intake into the subsoil are the main concerns in management.

Most areas are in native grass. Alfalfa, sorghum, and small grain are suitable crops.

Wind stripcropping and crop residue management or stubble mulching help meet management needs. Grasses and legumes in the crop rotation and green-manure crops are beneficial.

CAPABILITY UNIT IVs-2

Mosher soils, the only soils in this unit, are deep, nearly level to sloping silty soils that have a claypan subsoil.

These soils have very slow permeability. Surface runoff is slow, and available water capacity is low to medium. The dense claypan subsoil restricts root growth. Tilth generally deteriorates in cultivated areas.

Improving tilth and water intake is the main concern in management. Controlling soil blowing also is important.

Winter wheat and alfalfa are the main crops. Other small grain, sorghum, and tame grasses also are suitable. Most areas are in native grass.

Grass and legume crops and stubble mulching or residue management help meet management needs. Chiseling and subsoiling increase water intake, but benefits generally are temporary.

CAPABILITY UNIT IVs-3

This unit consists of moderately deep and deep, nearly level to gently sloping silty soils of the Cedar Butte and Wortman series. These soils have a silt loam surface layer and a dense claypan subsoil of silty clay loam or clay.

Permeability is very slow. Surface runoff is slow to moderate, and available water capacity is low to medium. The dense claypan subsoil restricts root growth. Tilth generally deteriorates rapidly in cultivated areas.

Improving tilth and water intake and controlling water erosion and soil blowing are the main concerns in management.

Most areas are in native grass. Small grain, sorghum, alfalfa, and tame grasses are suitable crops.

Grass and legume crops, stubble mulching or crop residue management, and contour stripcropping help meet management needs. Wind stripcropping is essential in areas where soil blowing is a greater risk than water erosion. Chiseling and subsoiling increase water intake, but benefits generally are temporary.

CAPABILITY UNIT VIe-3

This unit consists of moderately deep, sloping and strongly sloping silty soils of the Huggins, Keota, and Norrest series. Siltstone is within a depth of 40 inches. Also in this unit are shallow silty and loamy soils of the Epping and Imlay series. Epping soils are mapped with Huggins and Keota soils, and Imlay soils are mapped with Norrest soils.

These soils are highly erodible and have low to medium available water capacity, medium to low fertility, and moderate to rapid runoff. They are not suitable for cultivation.

Most areas are in native grass. Proper use of range helps control erosion and conserve moisture. Stockwater dams and dugouts are the main source of water for livestock.

CAPABILITY UNIT VIe-4

This unit consists of moderately deep, sloping and strongly sloping clayey soils of the Lakoma, Larvie, and Opal series. Shale or mudstone is at a depth of 20 to 40 inches. Also in this unit are Conata, Murdo, Samsil, and Tuthill soils. Conata and Samsil soils are shallow over shale, and Murdo soils are shallow over sand and gravel. Tuthill soils are deep and loamy. Conata soils are mapped with Larvie soils, Murdo and Samsil soils are mapped with Lakoma soils, and Tuthill soils are mapped with Opal soils.

These soils are too erodible to be suitable for cultivation. Permeability is very slow to slow, and surface runoff is moderate to rapid. Available water capacity is low to very low.

Most areas are in native grass. Proper range use helps control erosion and conserve moisture. Dams and dugouts are the main source of water for livestock.

CAPABILITY UNIT VIe-6

This unit consists of deep, rolling to hilly loamy soils of the Anselmo and Manter series. These soils have a surface layer of fine sandy loam and a subsoil of fine sandy loam or sandy loam. Also in this unit are shallow clayey soils of the Samsil series that are mapped with Manter soils.

These soils are too erodible to be suitable for cultivation. Surface runoff is moderate. Permeability is moderately rapid, and available water capacity is low to medium.

Most areas are in native grass. Proper range use helps control water erosion and soil blowing. In some areas springs and shallow wells provide water for livestock.

CAPABILITY UNIT VIe-7

This unit consists of Sandy land and deep, gently undulating to steep sandy soils of the Dunday and Valentine series. Loose sand is at or near the surface. These soils blow easily if disturbed and are not suitable for cultivation.

Nearly all areas are in native grass. Proper range use helps control soil blowing. Shallow wells provide water for livestock.

CAPABILITY UNIT VIe-8

This unit consists of deep, nearly level, calcareous sandy soils of the Bankard series. The surface layer is typically loamy very fine sand. The underlying material is very fine sand.

Surface runoff is slow to very slow, and flooding is a hazard. Available water capacity, organic-matter content, and fertility are all low. Soil blowing is a serious hazard in cultivated areas.

Most areas are in native grass. Proper range use is essential for control of soil blowing.

CAPABILITY UNIT VIw-1

This unit consists of deep, nearly level silty soils of the Buffington and Haverson series. These soils are in narrow tracts that are dissected by meandering stream channels. They are subject to stream overflow.

Most areas are in native grass and are used for grazing. Native trees and shrubs provide winter protection for livestock and wildlife. Proper range use helps minimize flood damage. Grade stabilization structures help control streambank erosion, which is a concern in some areas.

CAPABILITY UNIT VIs-1

This unit consists of Slickspots and moderately deep and deep, nearly level to strongly sloping silty and clayey soils of the Hisle, Hoven, Kolls, Minatare, Stirk, and Wanblee series. These soils have a claypan, or a dense clay subsoil, that restricts root development.

Surface runoff ponds on Hoven and Kolls soils and is slow to moderate on the rest. Permeability is slow to very slow. Tilth is very poor.

These soils are not suitable for cultivation. Almost all the acreage is in native grass and is used for grazing. Proper range use helps maintain an adequate cover of vegetation.

CAPABILITY UNIT VIs-2

In this unit are sloping to strongly sloping silty and loamy soils that are shallow over bedrock. These are soils of the Epping and Imlay series. Bedded siltstone is within a depth of 20 inches. Also in this unit are shallow clayey soils of the Conata series and moderately deep silty soils of the Huggins series. Conata soils are mapped with Imlay soils, and Huggins soils are mapped with Epping soils.

These soils have rapid runoff and very low available water capacity. They are not suitable for cultivation. All areas are in native grass and are used for grazing. Proper range use is essential.

CAPABILITY UNIT VIs-3

This unit consists of nearly level to strongly sloping clayey soils that are shallow over bedrock. These are soils of the Conata, Orella, and Samsil series. Shale or mudstone is within a depth of 20 inches. Also in this unit are moderately deep clayey soils of the Lakoma and Larvie series. Lakoma soils are mapped with Samsil soils, and Larvie soils are mapped with Conata soils.

Surface runoff is slow in a few areas of the nearly level Orella soils, but is moderate to rapid on the rest of the soils. Permeability is slow to very slow. Available water capacity is very low.

These soils are not suitable for cultivation. All areas are in native grass and are used for grazing. Proper range use is essential.

CAPABILITY UNIT VIs-4

This unit consists of gently sloping to strongly sloping loamy soils of the Murdo series. These soils have a surface layer of gravelly loam and a subsoil of gravelly clay loam. Sand and gravel is within a depth of 20 inches. Also in this unit are Lakoma and Schamber soils that are mapped with the Murdo series. Lakoma soils are moderately deep over shale and are clayey. Schamber soils are very shallow over gravel.

The Murdo soil has low available water capacity and is too droughty for cultivation.

Most areas are in native grass and are used for grazing. Springs and shallow wells provide water for livestock. Proper range use is essential.

CAPABILITY UNIT VIIe-1

Valentine fine sand, 15 to 35 percent slopes, the only soil in this unit, is loose sand that blows readily if the vegetation is disturbed.

All areas are in native grass and are used for grazing. Proper range use is the most effective means of controlling blowing.

CAPABILITY UNIT VIIe-2

Only Lakoma-Samsil clays, 15 to 40 percent slopes, is in this unit. Lakoma soils are moderately deep over shale. These soils have rapid runoff and are too highly erodible to be suitable for cultivation.

All areas are in native grass and are used for grazing. Water for livestock is provided mainly by dams and dugouts built to impound surface water. The siltation rate is high in heavily grazed areas. Proper range use is the most practical means of controlling erosion.

CAPABILITY UNIT VIIs-1

This unit consists of moderately steep to steep silty and loamy soils that are shallow over bedrock. These are soils of the Epping and Imlay series. Siltstone is within a depth of 20 inches. Also in this unit are Conata, Huggins, and Norrest soils. Conata soils are clayey. Huggins and Norrest soils are moderately deep over siltstone. Conata and Norrest soils are mapped with Imlay soils, and Huggins soils are mapped with Epping soils.

These soils have rapid surface runoff and are easily eroded. Available water capacity is very low in the Epping and Imlay soils. All areas are in native grass and are used for grazing. Proper range use is essential.

CAPABILITY UNIT VIIs-2

This unit consists of moderately steep to steep clayey soils that are shallow over bedrock. These are soils of the Samsil series. Soft shale is within a depth of 20 inches. Also in this unit are Lakoma, Manter, and Schamber soils that are mapped with Samsil soils. Lakoma soils are moderately deep. Manter soils are deep and loamy. Schamber soils are very shallow over sand and gravel.

The Samsil soil has rapid surface runoff and is highly erodible. Available water capacity is very low. Shallowness over shale and the erosion hazard make this soil unsatisfactory for cultivation.

All areas are in native grass and are used for grazing. Water for livestock is provided by dams and dugouts. The siltation rate is high. Proper range use is essential.

CAPABILITY UNIT VIIs-4

In this unit are moderately steep to steep loamy soils of the Schamber series. These soils are commonly gravelly. They are less than 10 inches deep over sand and gravel. Also in this unit are Murdo and Samsil soils that are mapped with the Schamber series. Murdo soils are shallow over sand and gravel. Samsil soils are shallow over shale.

These soils have moderate to rapid surface runoff, are droughty, and are not suitable for cultivation. All areas are in native grass and are used for grazing. Springs provide water for livestock. Proper range use is essential.

CAPABILITY UNIT VIIIs-2

This unit consists of areas of Badland, Barren badland, and Shale outcrop. These areas support little or no vegetation. Some areas provide a limited amount of browse for wildlife.

Yield Predictions

Table 2 lists the predicted average yields per acre of alfalfa, corn, oats, sorghum, and wheat for each of the arable soils in the county. These predictions are for dryfarmed soils under two levels of management.

The predicted yields shown in column A are those that can be expected under management that is customarily practiced in the county. The two most commonly used cropping systems are winter wheat alternated with fallow and row crops alternated with spring-sown small grain. Stands of alfalfa and tame grasses generally remain in a field until they fail or become unproductive. Some management meets management objectives, but is not sufficient to meet all the management needs of a particular soil.

The predicted yields shown in column B are those that can be expected under improved management, which includes (1) using a cropping system that supplies organic matter and helps maintain fertility and tilth; (2) using practices needed to control erosion and conserve moisture; (3) planting adapted crop varieties; (4) controlling weeds, insects, and plant diseases; (5) planting, cultivating, and harvesting at the proper time; and (6) adding commercial fertilizer in amounts indicated by soil tests and field trials.

The yield predictions were based on information furnished by farmers and by agricultural specialists familiar with the soils of the county. They were then compared and reconciled with agricultural statistics of the South Dakota Crop and Livestock Reporting Service (*4*).

TABLE 2.—*Predicted average yields per acre of principal dryfarmed crops under two levels of management*

[Figures in columns A indicate yields under prevailing management; figures in columns B indicate yields under improved management. Absence of figure indicates the crop is not suited to or is not commonly grown on the soil specified. Only soils suitable for crops are listed. Yields for soil complexes are weighted averages based on the proportionate extent and relative productivity of the soils in the complex]

Soil	Winter wheat		Corn		Grain sorghum		Oats		Alfalfa	
	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*
Altvan loam, 5 to 9 percent slopes	15	20	----	----	----	----	16	25	0.6	1.0
Bankard and Glenberg soils:										
Bankard soil	----	----	----	----	----	----	----	----	----	----
Glenberg soil	17	25	20	28	24	32	24	31	1.2	1.7
Blackpipe soils	24	30	22	30	28	35	28	38	1.2	1.6
Buffington silty clay loam	18	23	----	----	28	34	28	34	1.0	1.3
Buffington silty clay	17	22	----	----	28	34	28	34	1.0	1.3
Buffington clay	17	22	----	----	26	30	26	30	1.0	1.3
Buffington-Minatare complex	15	19	----	----	22	27	24	29	.8	1.0
Caputa loam, 2 to 5 percent slopes	23	30	22	30	27	36	27	37	1.1	1.4
Caputa loam, 5 to 9 percent slopes	20	27	20	27	25	33	24	33	1.0	1.3
Cedar Butte association	13	18	----	----	----	----	19	25	.7	1.0
Dunday and Anselmo soils, 0 to 6 percent slopes:										
Dunday soil	----	----	----	----	----	----	----	----	----	----
Anselmo soil	----	----	20	25	26	30	27	33	.9	1.4
Duroc and Kadoka silt loams, 0 to 2 percent slopes	29	38	27	35	34	40	36	45	1.3	1.8
Duroc and Kadoka silt loams, 2 to 5 percent slopes	27	35	25	33	31	37	33	42	1.1	1.5
Glenberg fine sandy loam	17	25	22	28	24	32	24	31	1.2	1.7
Haverson silt loam	21	28	24	30	28	34	27	36	1.3	1.9
Haverson silty clay loam	21	28	24	30	28	34	27	36	1.3	1.9
Haverson soils	21	28	24	30	28	34	27	36	1.3	1.9
Huggins silt loam, 2 to 5 percent slopes	20	26	19	25	26	30	27	34	.7	1.0
Huggins silt loam, 5 to 9 percent slopes	17	22	----	----	22	26	24	31	.6	.9
Huggins-Kadoka silt loams, 0 to 2 percent slopes	24	29	22	29	30	38	32	40	.9	1.2
Huggins-Kadoka silt loams, 2 to 5 percent slopes	22	27	20	27	28	36	28	36	.8	1.1
Huggins and Wortman silt loams, 2 to 5 percent slopes:										
Huggins soil	20	26	19	25	26	30	27	34	.7	1.0
Wortman soil	10	13	----	----	16	20	17	22	.7	.9
Kadoka-Kube silt loams	25	32	24	32	28	36	32	40	1.0	1.4
Kyle clay	15	20	----	----	----	----	18	24	.7	.9
Larvie clay, 5 to 9 percent slopes	----	----	----	----	----	----	16	21	.7	1.1
Larvie and Hisle soils:										
Larvie soil	----	----	----	----	----	----	16	21	.7	1.0
Hisle soil	----	----	----	----	----	----	----	----	----	----
Larvie-Metre clays, 2 to 5 percent slopes	----	----	----	----	----	----	20	27	.8	1.2
Lowry silt loam, 0 to 2 percent slopes	21	30	23	31	34	42	34	44	1.1	1.5
Lowry silt loam, 2 to 5 percent slopes	20	28	21	29	32	40	32	41	1.1	1.4
Lowry-Slickspots complex	17	24	19	26	28	34	29	37	.9	1.1
Manter-Tuthill fine sandy loams, 6 to 9 percent slopes	----	----	----	----	----	----	20	27	.7	1.0
Millboro-Reliance complex, 2 to 5 percent slopes	25	34	23	28	32	37	32	43	1.2	1.6
Millboro-Reliance complex, 5 to 9 percent slopes	21	29	18	25	29	34	29	38	1.0	1.4
Mitchell silt loam	14	21	18	25	20	30	20	30	1.0	1.5

TABLE 2.—*Predicted average yields per acre of principal dryfarmed crops under two levels of management*—Continued

Soil	Winter wheat		Corn		Grain sorghum		Oats		Alfalfa	
	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*
Mosher soils	13	19	------	------	------	------	18	25	.7	1.0
Norrest silt loam, 5 to 9 percent slopes	18	25	------	------	24	30	26	34	.9	1.1
Norrest-Blackpipe silt loams, 0 to 2 percent slopes	22	28	21	30	28	35	26	36	.9	1.3
Norrest-Blackpipe silt loams, 2 to 5 percent slopes	20	26	19	27	26	32	25	34	.9	1.2
Norrest-Cedar Butte silt loams, 3 to 9 percent slopes	16	21	------	------	------	------	21	29	.8	1.0
Norrest-Imlay silt loams, 5 to 9 percent slopes:										
Norrest soil	18	25	------	------	------	------	22	30	.9	1.1
Imlay soil	------	------	------	------	------	------	------	------	------	------
Norrest and Okreek soils, 2 to 5 percent slopes	20	26	19	27	26	32	25	34	.9	1.2
Opal clay, 5 to 9 percent slopes	18	24	12	18	25	30	20	30	.9	1.3
Opal clay, mounded, 5 to 9 percent slopes	18	24	12	18	25	30	20	30	.9	1.3
Opal-Caputa complex, 2 to 5 percent slopes	22	29	17	24	30	35	26	36	1.1	1.4
Opal-Caputa complex, 5 to 9 percent slopes	19	24	14	20	26	31	24	30	.9	1.3
Opal-Mosher complex, 2 to 6 percent slopes	19	25	12	19	26	31	22	30	1.0	1.3
Opal-Promise clays, 2 to 5 percent slopes	21	30	16	23	30	35	31	40	1.0	1.4
Opal-Tuthill complex, 2 to 5 percent slopes	21	28	15	23	30	36	27	37	1.0	1.4
Opal-Woodly complex, 3 to 9 percent slopes	21	28	16	24	27	33	26	34	1.0	1.4
Promise clay, 0 to 2 percent slopes	24	33	17	24	33	38	32	45	1.1	1.5
Promise clay, 2 to 5 percent slopes	22	31	16	23	30	35	31	43	1.0	1.5
Promise soils	26	35	19	26	35	40	34	47	1.3	1.8
Promise and Opal clays, 0 to 2 percent slopes	24	33	17	24	33	38	32	45	1.1	1.5
Promise and Opal clays, 2 to 5 percent slopes	22	31	16	23	30	35	31	43	1.0	1.5
Promise-Mosher complex, 0 to 2 percent slopes	22	30	14	20	29	34	29	39	1.0	1.4
Promise soils and Slickspots:										
Promise soil	24	33	------	------	------	------	32	45	1.1	1.5
Slickspots	------	------	------	------	------	------	------	------	------	------
Ree loam, 2 to 5 percent slopes	21	30	22	29	32	42	34	44	1.1	1.5
Ree and Keya loams, 0 to 2 percent slopes	27	35	29	38	35	46	38	48	1.4	1.9
Ree and Keya loams, 2 to 5 percent slopes	25	33	27	35	33	44	35	45	1.2	1.6
Savo silty clay loam, 0 to 2 percent slopes	24	31	23	31	35	46	33	41	1.3	1.6
Savo silty clay loam, 2 to 5 percent slopes	22	29	20	27	33	42	30	38	1.1	1.6
Savo silty clay loam, 5 to 9 percent slopes	17	24	16	24	30	38	26	33	.9	1.3
Tuthill fine sandy loam, 3 to 6 percent slopes	21	28	18	27	27	36	30	38	.9	1.4
Tuthill-Opal complex, 2 to 9 percent slopes	18	25	14	20	26	34	21	30	.9	1.3
Tuthill and Whitelake fine sandy loams, 0 to 5 percent slopes:										
Tuthill soil	21	28	18	27	30	40	30	38	.9	1.4
Whitelake soil	------	------	------	------	------	------	24	29	.9	1.4
Tuthill-Woodly fine sandy loams, 0 to 3 percent slopes	23	30	22	30	33	42	33	42	1.2	1.6
Tuthill-Woodly fine sandy loams, 3 to 6 percent slopes	21	28	20	28	30	40	30	39	1.1	1.5
Woodly fine sandy loam	24	33	24	31	35	40	34	42	1.4	1.8
Woodly-Opal complex, 2 to 5 percent slopes	21	28	19	27	30	36	30	38	1.1	1.5
Wortman and Wanblee silt loams:										
Wortman soil	9	12	------	------	------	------	------	------	.6	.8
Wanblee soil	------	------	------	------	------	------	------	------	------	------

Windbreaks [5]

About 7,200 acres in Mellette County is wooded. The more dense stands, chiefly American elm, boxelder, bur oak, cottonwood, green ash, and willow, are on bottom land along the principal streams (fig. 12). On the better sites, cottonwood at maturity reaches a height of as much as 45 feet. Ponderosa pines, growing singly or in clumps, are on some of the ridges and escarpments in areas of Badland and in steep areas near the Little White River. Native woodland furnishes some rough lumber, fuel, and fenceposts for farmers and ranchers, but its principal value is the protection it provides for livestock and wildlife.

The main reason for planting trees in Mellette County is to establish windbreaks for the protection of fields, farmsteads, and winter feeding areas for livestock. Many of the existing windbreaks need supplemental plantings to make them more effective in keeping yards free from snow, in protecting livestock and buildings, in controlling soil blowing, and in conserving moisture.

Farmstead and feedlot windbreaks are narrow belts of trees designed to protect yards, lots, buildings, and livestock from the wind. A minimum of seven rows of trees and shrubs provides adequate protection. The inside row should be far enough from the area that is to be protected so that snow does not accumulate in the area.

Field windbreaks are strips or belts of trees and shrubs that are within or around a field. Their purpose is to control soil blowing, to conserve moisture, and to lessen crop injury from hot summer winds. They may be one-row plantings or multirow plantings that have as many as five rows in order to obtain the protection needed. On sloping soils, plantings on the contour help control

[5] By ELMER L. WORTHINGTON, woodland conservationist, Soil Conservation Service.

Figure 12.—Native trees along channel in area of Buffington silty clay loam, channeled.

erosion and conserve moisture for tree growth. In order to assist in planning and establishing windbreaks, the soils of Mellette County have been grouped according to their suitability for trees. Table 3 lists the species best suited to each windbreak suitability group. Tree heights listed are based on measurements and observations of windbreaks that are at least 20 years old and have received adequate care. Criteria that determine the condition class of each species in a suitability group follow. One or more of the following apply:

Good.—Leaves or needles are normal in color and growth; only small amounts of dead wood are within the live crowns; little or no disease, insect, and climate damage is evident; only slight suppression or stagnation is apparent.

Fair.—Leaves or needles are abnormal in color and growth; substantial amounts of dead wood are within the live crowns; evidence of moderate disease, insect, or climate damage is obvious; definite suppression or stagnation is apparent; current year's growth is less than normal.

Poor.—Leaves or needles are noticeably abnormal in color and growth; large amounts of dead wood are within the live crowns; evidence of extensive disease, insect, and climate damage is obvious; plants show the effect of severe stagnation, suppression, or decadence; current year's growth is negligible.

The windbreak suitability groups in Mellette County are described in the following paragraphs. These groups are not numbered consecutively because not all of the groups in the statewide system are used in this county. Except for the description of group 10, the description of each group gives the names of the soil series in that group; this does not mean that all the soils of a given series are in that one group. To find the windbreak group of a given soil, refer to the "Guide to Mapping Units."

WINDBREAK GROUP 1

Deep silty and loamy soils of the Haverson and Keya series are in this group. They are on bottom land and in upland swales. Permeability is moderate. Available water capacity is high except in some areas of Keya soils. Additional moisture is received as stream overflow or as runoff from adjacent sloping soils. The moisture regime is more favorable for the growth of trees on these soils than on most soils in the county.

Soils of this group are well suited to plantings for the protection of fields, farmsteads, and feedlots, and to plantings for recreation sites and wildlife.

WINDBREAK GROUP 2

Deep loamy soils of the Glenberg series are in this group. They are fine sandy loams on bottom land and low terraces. In some areas they are subject to stream

overflow, and in other areas a water table is within reach of tree roots.

These soils are well suited to plantings for the protection of fields, farmsteads, and feedlots. They also are suited to plantings for recreation sites and wildlife. Ordinarily no fallowing is needed in preparing a site for planting. Soil blowing is a hazard.

WINDBREAK GROUP 3

Moderately deep and deep, well-drained silty and loamy soils of the Blackpipe, Buffington, Caputa, Duroc, Kadoka, Kube, Lowry, Ree, Reliance, and Savo series are in this group. Available water capacity is medium to low in the moderately deep Blackpipe and Kadoka soils and medium to high in the rest. Permeability is moderate to moderately slow.

Soils in this group are well suited to plantings for all purposes. Fallowing during the year preceding planting is a necessary part of site preparation.

WINDBREAK GROUP 4

Deep and moderately deep silty and clayey soils of the Buffington, Huggins, Kyle, Larvie, Metre, Millboro, Norrest, Okreek, Opal, and Promise series are in this group. All have a subsoil that is high in clay content. The clayey subsoil and the siltstone or shale underlying many of these soils limit the development of tree roots. All but the Buffington soil have medium to very low available water capacity. Permeability is moderately slow to very slow.

Soils of this group are moderately well suited to plantings of all kinds, although the height of growth may be less than desired. Fallow is a necessary part of site preparation.

WINDBREAK GROUP 5

Deep loamy soils of the Anselmo, Manter, Tuthill, Whitelake, and Woodly series are in this group. These soils have a surface layer of fine sandy loam and a subsoil of sandy loam to sandy clay loam. They are subject to blowing. They take in water readily. Permeability generally is moderate to moderately rapid, but is moderately slow to slow in the Whitelake soil. Available water capacity is medium to low.

Soils of this group are well suited to all types of plantings if soil blowing is controlled Either fall or spring site preparation is suitable for these soils. Liberal use of crop residue or cover crops before and after planting helps to control soil blowing until the trees are tall enough to provide protection.

WINDBREAK GROUP 6

Altvan loam, 5 to 9 percent slopes, is the only soil in this group. Sand and gravel is between depths of 20 and 40 inches. Thus, the available water capacity is low, the soil is droughty, and the root zone is shallow.

This soil is poorly suited to windbreak plantings. It is suited to other plantings if optimum growth is not a critical factor. Fallow is a necessary part of site preparation. Planting on the contour also helps conserve moisture.

WINDBREAK GROUP 8

Mitchell silt loam is the only soil in this group. It is high in lime content and low in fertility. It blows easily.

This soil is moderately well suited to windbreak plantings. Liberal use of crop residue or cover crops before and after planting helps to control soil blowing.

WINDBREAK GROUP 9

Deep and moderately deep silty soils of the Cedar Butte, Mosher, and Wortman series are in this group. These soils have a claypan subsoil that contains sodium. Permeability is very slow in the dense claypan. The lower part of the subsoil and the underlying material commonly contain other salts. The salts and the pan limit the development of many species.

Soils of this group are poorly suited to windbreak plantings. They can be used for other types of plantings if growth and vigor are not critical factors.

WINDBREAK GROUP 10

This group consists of soils that are too shallow or too steep for trees and shrubs normally planted with machinery. If hand planted and well managed, plantings can be established for wildlife and on recreation sites. Only trees and shrubs tolerant of conditions at a specific site are to be selected for planting.

Many soils in Mellette County are in this group. They are identified at the end of the respective mapping unit descriptions and in the "Guide to Mapping Units" at the back of the survey.

Wildlife [6]

Soils can be managed specifically for wildlife. Providing a habitat for wildlife also can be a byproduct of soil management for other purposes. A specific kind of wildlife may require several different kinds of habitat to meet its individual needs. Nesting sites differ from loafing areas, and protective vegetation differs from vegetation for food. The nature and adequacy of habitat are closely related to the suitability of a soil for growing the kind of plants that make up the habitat of a specific kind of wildlife.

The potential of the soil for providing habitat can be related to the 11 soil associations in Mellette County. In the following paragraphs the associations are grouped into four wildlife areas that differ in potential, species, and environmental factors. The term wildlife, as used in this part of the survey, refers mainly to game species.

WILDLIFE AREA 1

Wildlife area 1 consists of the Samsil-Lakoma association, the Imlay-Conata-Badland association, and the Epping-Huggins-Imlay association. Most of these soils are silty to clayey and are shallow over shale, mudstone, and siltstone. The landscape in many parts is steep and broken. Drainageways are deeply entrenched. Numerous escarpments, many of which are barren of vegetation, are in the Imlay-Conata-Badland association. Almost all areas but Barren badland and a few scattered tracts of cropland are in native vegetation. Mid and short grasses are dominant, but tall grasses grow in swales and along drainageways. Stringers of trees and shrubs are in many

[6] By JOHN B. FARLEY, biologist, Soil Conservation Service.

TABLE 3.—*Condition class and height of*

[For definitions of condition classes, see text. Projected condition and heights are for trees

Species	Windbreak groups [1]					
	Group 1		Group 2		Group 3	
	Condition	Height	Condition	Height	Condition	Height
		Ft.		*Ft.*		*Ft.*
Rocky Mountain juniper	Good	13–15	Good	12–14	Good [2]	[2] 10–12
Ponderosa and Austrian pines	Good	20–24	Good	16–18	Good [2]	[2] 18–20
Black Hills and Colorado blue spruce	Good	20–24	Good	18–20	Fair [2]	[2] 17–19
Buffaloberry	Good	6–8	Fair	5–7	Fair	5–7
Caragana	Good [2]	[2] 8–10	Good	7–9	Good [2]	[2] 8–9
Chokecherry	Good [2]	10–12	Good	8–10	Good [2]	[2] 8–11
Cotoneaster	Good	4–5	Good	4–5	Good	4–5
Crabapple	Good	12–14	Fair	11–13	Good [2]	[2] 11–13
Harbin pear	Good	12–14	Good	10–12	Good	11–13
Honeysuckle	Good	6–8	Fair	5–7	Good [2]	[2] 6–8
Lilac	Good	5–6	Fair	4–5	Good [2]	[2] 6–7
Nanking cherry	Fair	4–5	Fair	4–5	Fair	4–5
Plum	Good	7–8	Fair	4–5	Good [2]	[2] 7–8
Russian olive	Fair	14–16	Fair	12–14	Fair [2]	[2] 15–17
Boxelder	Fair	15–17	Fair	14–16	Fair [2]	[2] 15–17
Cottonwood	Fair	30–35	Fair	28–30	Poor	
American elm	Good [2]	[2] 23–35	Fair	18–20	Good [2]	18–20
Siberian, dropmore, and Chinkota elms	Good [2]	[2] 25–30	Good	23–27	Good [2]	[2] 24–26
Green ash	Good [2]	[2] 18–22	Good	16–18	Good [2]	[2] 14–16
Hackberry	Good	16–18	Good	12–14	Good [2]	[2] 12–14
Honeylocust	Good	25–27	Good	20–22	Fair [2]	[2] 18–20
White and golden willows	Good	28–32	Good	24–26	Poor	

[1] Windbreak group 10 is not suited to trees and shrubs.

areas of narrow bottom land along entrenched drainageways.

The habitat in this wildlife area is excellent for mule deer, prairie chicken, and sharp-tailed grouse. Coyote and fox are most abundant in the Samsil-Lakoma association part of this wildlife area. Prairie dog towns are in the more gently sloping parts of the Imlay-Conata-Badland association. The black-footed ferret, a member of the weasel family, is a predator of pairie dogs and has been observed near the prairie dog towns. It is on the list of endangered species.

Impoundments constructed for livestock water are the major source of water for wildlife in this area. Many ponds in the Samsil-Lakoma association are deep enough to provide favorable habitat for rainbow trout. Others are favorable for bass, bluegill, and channel catfish. Many ponds in the Imlay-Conata-Badland association, however, are persistently turbid and are not favorable for fish.

WILDLIFE AREA 2

Wildlife area 2 consists of the Norrest association, the Opal-Promise-Samsil association, and the Promise-Millboro association. These are silty and clayey soils that are mostly moderately deep and deep over siltstone and shale. Except for the steep sides of some entrenched drainageways, the landscape is mostly nearly level to strongly sloping. Except for areas of cropland in the eastern part of the county and areas of scattered trees and shrubs along the larger drainageways, most areas are in native grass.

The extensive grassland areas have a high potential for antelope, sharp-tailed grouse, and deer. Cropland areas have potential for pheasant, mourning dove, sharp-tailed grouse, and prairie chicken. The cropland areas in the eastern part of the county attract a small number of Hungarian partridge and also provide a limited amount of field feeding for migrating waterfowl.

The larger ponds in the area have good potential as fisheries for bass, bluegill, and channel catfish. Some ponds in the Norrest association, however, are in the same turbid condition as those in the Imlay-Conata-Badland association. The larger ponds in the grassland areas also provide habitat for ducks and shore birds.

WILDLIFE AREA 3

Wildlife area 3 consists of the Huggins-Kadoka association, the Ree association, the Savo association, and the Tuthill-Manter association. The soils of the Huggins-Kadoka association are silty and are moderately deep over siltstone. The soils of the other associations are deep loamy and silty soils that formed in material deposited by wind or water. The landscape is nearly level to gently sloping. Extensive areas are used for crops.

This wildlife area has good potential for pheasant, mourning dove, sharp-tailed grouse, and prairie chicken. Field windbreaks provide protection for pheasant in winter in the areas of cropland. Those parts of this wildlife area that are adjacent to wildlife area 1 also provide feeding grounds for deer, prairie chicken, and sharp-tailed grouse.

specified trees and shrubs by windbreak groups

and shrubs at 20 years of age. Estimates of height not given for species rated poor]

Windbreak groups [1]—Continued									
Group 4		Group 5		Group 6		Group 8		Group 9	
Condition	Height	Condition	Height	Condition	Height	Condition	Height	Condition	Height
	Ft.		*Ft.*		*Ft.*		*Ft.*		*Ft.*
Good	13–15	Good [2]	11–13	Fair	7–9	Fair	8–10	Fair	5–7
Good	15–17	Good	18–20	Fair	11–13	Fair	12–24	Fair	9–11
Poor		Poor		Poor		Poor		Poor	
Good	5–7	Fair	5–6	Poor		Poor		Fair	3–4
Good	6–8	Good	8–10	Fair	4–5	Poor		Fair	4–5
Good	8–10	Fair	8–11	Poor		Poor		Poor	
Good	4–5	Good	4–5	Poor		Poor		Poor	
Fair	10–12	Fair	11–13	Poor		Poor		Poor	
Fair	9–11	Good	11–13	Poor		Poor		Fair	4–6
Fair	5–7	Fair	4–6	Poor		Poor		Poor	
Good	4–5	Fair	4–5	Fair	3–4	Poor		Fair	3–4
Fair	4–5	Poor		Poor		Poor		Poor	
Fair	4–5	Good	5–6	Poor		Poor		Poor	
Fair	12–14	Fair [2]	[2] 15–17	Fair	7–9	Poor		Fair	8–9
Poor		Poor		Poor		Poor		Poor	
Poor		Poor		Poor		Poor		Poor	
Fair	[2] 18–20	Fair [2]	[2] 18–20	Poor		Poor		Poor	
Good	23–25	Good	22–24	Fair	11–13	Poor		Fair	10–12
Good	14–16	Good	14–16	Fair	9–11	Poor		Fair	9–11
Good	12–14	Good [2]	[2] 16–18	Fair	11–13	Poor		Poor	
Good	24–26	Fair	20–22	Fair	11–13	Poor		Poor	
Poor		Poor		Poor		Poor		Poor	

[2] Projected conditions and heights are based on measurements rather than age.

WILDLIFE AREA 4

Wildlife area 4 is the Haverson-Glenberg association. Some areas of this bottom land are cultivated and others are in native grass and are used for hay and winter grazing. Native trees and shrubs on the lower flood plains help provide a favorable habitat for most of the wildlife species in the county. This association is heavily used as winter habitat by grouse, pheasant, and deer. Areas along the Little White River have been stocked with Rio Grande wild turkey.

The Little White River has high-quality water and provides a favorable habitat for trout as well as other fish. The White River carries a heavy silt load and is favorable only to species such as catfish. These rivers also provide habitat favorable to aquatic furbearers, such as beaver, muskrat, and mink.

Soils and Engineering [7]

This section provides information of special interest to engineers, contractors, farmers, and others who use soil as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and country planners, town and city managers, sanitarians, land developers, and architects and realtors who are concerned with soils and their limitations in land use planning and development.

[7] By Gordon Stroup, assistant State conservation engineer, Soil Conservation Service.

Some properties are of special interest to engineers because they affect construction and maintenance of roads and airports, pipelines, building foundations, water storage facilities, erosion control structures, drainage systems, and sewage disposal systems. Among the properties most important to engineers are permeability, shear strength, density, shrink-swell potential, available water capacity, grain-size distribution, plasticity, and reaction.

Information concerning these and related soil properties is furnished in tables 4, 5, and 6. The estimates and interpretations in these tables can be used in—

1. Evaluating potential areas for residential, industrial, commercial, and recreational uses. Important factors are depth to bedrock, seasonal high water table, susceptibility to flooding, and permeability of the soil.
2. Evaluating potential locations for roads, highways, airports, pipelines, and underground cables. Important factors are depth to bedrock, depth to water table, soil permeability, frequency of flooding, and susceptibility to sliding.
3. Locating areas that are probable sources of sand, gravel, or road fill suitable for use as construction material. Important factors are depth to water table, abundance of stones and boulders, thickness of the deposits, shrink-swell potential, susceptibility to frost, and moisture content.
4. Planning of drainage systems, farm ponds, irrigation systems, diversion terraces, and other structures for controlling water and conserving

soil. Important factors are permeability and seepage rate; depth to water table; slope; available water capacity; depth to a layer (hardpan, claypan, bedrock, or sand and gravel) that influences the rate of water movement; and flooding or stream overflow.

The engineering interpretations reported here do not eliminate the need for sampling and testing at the site

TABLE 4.—*Estimates of soil*

[Absence of data indicates that no estimate was made. An asterisk in the first column indicates that at least one mapping unit in this reason it is necessary to follow carefully the instructions for referring to other series

Soil series and map symbols	Depth to—		Depth from surface	Classification		
	Bedrock	Seasonal high water table		Dominant USDA texture	Unified	AASHO
	Ft.	*Ft.*	*In.*			
Altvan: AlC	>5	>5	0–7	Loam	ML or ML–CL	A–4 or A–6
			7–12	Clay loam	CL	A–6 or A–7
			12–28	Clay loam	CL	A–6 or A–7
			28–60	Sand and gravel	GC or SC	A–1 or A–2
Anselmo	>5	>5	0–9	Fine sandy loam	SM	A–4
			9–16	Fine sandy loam	SM	A–4
			16–60	Fine sand	SM	A–2
Mapped only with Dunday and Manter soils.						
Badland: Ba.						
No valid estimates can be made.						
*Bankard: Bg	>5	5–10	0–16	Loamy very fine sand	SM or ML	A–2 or A–4
			16–60	Very fine sand	SM	A–2
For Glenberg part of Bg, see Glenberg series.						
Barren badland: Bk.						
No valid estimates can be made.						
Blackpipe: Bp	2–3½	>5	0–4	Silt loam	ML or CL	A–4 or A–6
			4–12	Silty clay loam	CL	A–7
			12–17	Silty clay	CL or CH	A–7
			17–22	Silty clay loam	CL	A–7
			22–32	Loam	ML or ML–CL	A–4 or A–6
			32–60	Shale.		
*Buffington: Br, Bs, Bt, Bu, Bv, Bw, Bx	>5	>5	0–16	Silty clay loam	CL	A–7
			16–25	Silty clay	CL or CH	A–7
			25–40	Silty clay loam	CL	A–7
			40–60	Silt loam	CL or ML–CL	A–6
For Minatare part of Bx, see Minatare series.						
Caputa: CaB, CaC	>5	>5	0–3	Loam	ML or ML–CL	A–6 or A–4
			3–11	Clay loam	CL or CH	A–7
			11–60	Clay loam	CL or CH	A–6 or A–7
Cedar Butte: Ce	>5	>5	0–6	Silt loam	ML or CL	A–4 or A–6
			6–12	Clay	CH	A–7
			12–42	Silty clay	CH	A–7
			42–60	Gravelly sand	SC	A–2
*Conata: CIE	<2	>5	0–17	Clay	CH or MH–CH	A–7
			17–60	Mudstone.		
For Larvie part of CIE, see Larvie series.						
*Dunday: DsC, DtB, DuD	>5	>5	0–10	Loamy fine sand	SM	A–2 or A–4
			10–60	Fine sand	SM	A–2
For Anselmo part of DtB, see Anselmo series. For Valentine part of DuD, see Valentine series.						

of specific engineering works. The soil map is useful in planning more detailed field investigations and for indicating the kinds of problems that may be expected.

Some of the terms used by soil scientists have a special meaning in soil science that may not be familiar to engineers. These terms are defined in the Glossary at the back of this publication.

properties significant in engineering

series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this that appear in the first column of this table. >signifies greater than, and <less than]

Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)						Uncoated steel	Concrete
				In./hr.	*In./in. of soil*	*pH*	*Mmhos/cm.*			
100	100	85–95	65–80	1. 2–2. 0	0. 18–0. 20	6. 6–7. 3		Low	Low	Low.
100	100	90–100	70–85	0. 6–1. 2	0. 19–0. 22	6. 6–7. 3		Moderate	Moderate	Low.
100	100	90–100	70–85	0. 6–1. 2	0. 17–0. 20	7. 4–8. 4		Moderate	Moderate	Low.
50–75	40–60	20–50	10–35	6. 0–10. 0	0. 03–0. 06	7. 9–8. 4		Low	Low	Low.
100	100	70–95	40–50	2. 0–6. 0	0. 14–0. 17	6. 6–7. 3		Low	Low	Low.
100	100	70–95	35–50	2. 0–6. 0	0. 12–0. 15	6. 6–7. 3		Low	Low	Low.
100	100	65–85	20–30	6. 0–10. 0	0. 06–0. 08	6. 6–7. 3		Low	Low	Low.
100	100	90–95	30–60	2. 0–6. 0	0. 08–0. 10	7. 9–8. 4		Low	Low	Low.
100	100	70–90	25–35	6. 0–10. 0	0. 06–0. 08	8. 5–9. 0		Low	Low	Low.
100	100	90–100	70–90	1. 2–2. 0	0. 19–0. 22	6. 6–7. 3		Moderate	Low	Low.
100	100	95–100	90–95	0. 2–0. 6	0. 16–0. 19	6. 6–7. 3		High	Moderate	Low.
100	100	95–100	90–95	0. 2–0. 6	0. 11–0. 16	7. 4–7. 8		High	High	Low.
100	100	95–100	90–95	0. 2–0. 6	0. 14–0. 17	7. 9–8. 4		High	Moderate	Low.
100	100	85–95	60–75	0. 2–0. 6	0. 16–0. 18	7. 9–8. 4		Low to moderate.	Moderate	Low.
100	100	95–100	85–95	0. 6–1. 2	0. 19–0. 22	6. 6–7. 8		Moderate	High	Low.
100	100	95–100	90–95	0. 2–0. 6	0. 11–0. 16	7. 9–8. 4		High	High	Low.
100	100	95–100	85–95	0. 2–0. 6	0. 14–0. 17	7. 9–8. 4		Moderate	High	Low.
100	100	90–100	70–90	0. 6–1. 2	0. 17–0. 20	7. 9–8. 4		Low to moderate.	High	Low.
100	100	85–95	60–80	1. 2–2. 0	0. 18–0. 20	6. 6–7. 3		Low	Low	Low.
100	100	90–100	70–80	0. 2–0. 6	0. 16–0. 19	6. 6–7. 8		High	High	Low.
100	100	90–100	70–80	0. 2–0. 6	0. 14–0. 17	7. 4–9. 0		Moderate to high.	High	Moderate.
100	100	90–100	70–90	0. 6–2. 0	0. 17–0. 20	7. 4–7. 8		Low to moderate.	High	Low.
100	100	90–100	75–95	0. 02–0. 2	0. 10–0. 15	7. 4–8. 4		High	High	Moderate.
100	100	90–100	75–85	0. 02–0. 2	0. 08–0. 13	8. 5–9. 0		High	High	High.
70–80	50–60	20–30	5–15	6. 0–10. 0	0. 03–0. 06	7. 9–8. 4		Low	Low	Low.
100	100	90–100	75–95	<0. 06	0. 10–0. 14	7. 4–8. 4		High	High	Low.
100	95–100	65–90	30–40	2. 0–6. 0	0. 10–0. 12	6. 6–7. 3		Low	Low	Low.
100	95–100	65–80	20–35	6. 0–10. 0	0. 06–0. 08	6. 6–7. 3		Low	Low	Low.

TABLE 4.—*Estimates of soil properties*

Soil series and map symbols	Depth to—		Depth from surface	Classification		
	Bedrock	Seasonal high water table		Dominant USDA texture	Unified	AASHO
	Ft.	*Ft.*	*In.*			
*Duroc: DvA, DvB	>3½	>5	0–13	Silt loam	ML or ML–CL	A–4 or A–6
For Kadoka part of DvA and DvB, see Kadoka series.			13–22	Silty clay loam	CL	A–6
			22–29	Silty clay loam	CL	A–6
			29–44	Silt loam	ML or ML–CL	A–6 or A–4
			44–60	Siltstone.		
*Epping: EhD, EhE	<2	>5	0–18	Silt loam	ML	A–4
For Huggins part of EhD and EhE, see Huggins series.			18–60	Siltstone.		
Glenberg: Ge	>5	5–10	0–8	Fine sandy loam	SM	A–4
			8–54	Very fine sandy loam	SM or ML	A–4
			54–60	Fine sand	SM	A–2
Haverson: Ha, Hc, Hd, He	>5	>5	0–7	Silty clay loam	CL	A–6 or A–7
			7–18	Silty clay	CL	A–7
			18–58	Silt loam	CL or ML–CL	A–4 or A–6
			58–60	Fine sand	SM	A–2
*Hisle: HlD	2–3½	>5	0–1	Silt loam	ML or ML–CL	A–4 or A–6
For Orella part of HlD, see Orella series.			1–13	Silty clay	CH	A–7
			13–34	Silty clay loam	CH or MH	A–7
			34–60	Shale.		
Hoven	>5	>5	0–4	Silt loam	ML or ML–CL	A–4 or A–6
Mapped only with Kolls series.			4–26	Clay	CH	A–7
			26–40	Silty clay	CH	A–7
			40–60	Clay loam	CL or CH	A–6 or A–7
*Huggins: HnB, HnC, HpD, HuA, HuB, HwB.	2–3	>5	0–3	Silt loam	ML or CL	A–4 or A–6
			3–7	Silty clay loam	CL or CH	A–7
For Epping part of HpD, see Epping series. For Kadoka part of HuA and HuB, see Kadoka series. For Wortman part of HwB, see Wortman series.			7–22	Silty clay loam	CL or CH	A–7
			22–60	Soft siltstone.		
*Imlay: Ib, IcD, IcE, InE	<2	>5	0–4	Clay loam	CL	A–6
For Badland part of Ib, see Badland. For Conata part of IcD and IcE, see Conata series. For Norrest part of InE, see Norrest series.			4–10	Gravelly clay loam	CL	A–6
			10–26	Siltstone.		
*Kadoka: Ka	2–3½	>5	0–7	Silt loam	ML or ML–CL	A–4 or A–6
For Kube part of Ka, see Kube series.			7–11	Silty clay loam	CL	A–6
			11–25	Silty clay loam	CL or ML–CL	A–6
			25–31	Silt loam	ML or ML–CL	A–4
			31–40	Siltstone.		
*Keota: KeD	2–3½	>5	0–20	Silt loam	ML	A–4 or A–6
For Epping part of KeD, see Epping series.			20–36	Siltstone.		
Keya	>5	>5	0–16	Loam	ML or ML–CL	A–4 or A–6
Mapped only with Ree series.			16–34	Clay loam	CL	A–6 or A–7
			34–40	Clay loam	CL or ML–CL	A–6
			40–60	Gravelly sand	SM	A–2
*Kolls: Kh	>5	>5	0–18	Clay	CH or MH	A–7
For Hoven part of Kh, see Hoven series.			18–60	Clay	CH or MH	A–7

significant in engineering—Continued

Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)						Uncoated steel	Concrete
				In./hr.	*In./in. of soil*	*pH*	*Mmhos/cm.*			
100	100	90–100	70–90	1. 2–2. 0	0. 19–0. 22	6. 1–7. 3		Low	Moderate	Low.
100	100	95–100	85–95	0. 6–1. 2	0. 19–0. 22	6. 6–7. 3		Moderate	Moderate	Low.
100	100	95–100	85–95	0. 6–1. 2	0. 17–0. 20	6. 6–7. 3		Moderate	Moderate	Low.
100	100	90–100	70–90	0. 6–2. 0	0. 17–0. 20	6. 6–7. 3		Low	Low	Low.
90–100	90–100	85–100	70–90	0. 6–1. 2	0. 17–0. 20	7. 9–8. 4		Low	Moderate	Low.
100	100	70–95	35–50	2. 0–6. 0	0. 12–0. 15	7. 9–8. 4		Low	Low	Low.
100	100	85–95	35–60	2. 0–6. 0	0. 15–0. 17	8. 5–9. 0		Low	Low	Low.
100	100	60–80	20–35	6. 0–10. 0	0. 06–0. 08	8. 5–10. 0		Low	Low	Low.
100	100	95–100	85–95	0. 6–1. 2	0. 17–0. 20	7. 4–7. 8		Low	Moderate	Low.
100	100	95–100	90–95	0. 6–1. 2	0. 11–0. 16	7. 9–8. 4		High	High	Low.
100	100	90–100	70–90	0. 6–1. 2	0. 17–0. 20	7. 9–8. 4		Low	Moderate	Low.
100	100	65–80	20–35	6. 0–10. 0	0. 06–0. 08	7. 9–8. 4		Low	Moderate	Low.
100	100	90–100	70–90	1. 2–2. 0	0. 19–0. 22	6. 6–7. 3		Low	Low	Low.
100	100	95–100	90–95	<0. 06	0. 05–0. 09	7. 4–7. 8	2–4	High	High	Low.
100	100	95–100	90–95	0. 06–0. 2	0. 11–0. 14	7. 9–9. 0	2–4	High	High	Low.
100	100	90–100	70–90	0. 6–2. 0	0. 19–0. 22	6. 1–6. 5		Low	Moderate	Low.
100	100	90–100	75–95	<0. 06	0. 10–0. 15	6. 1–7. 3	2–4	High	High	High.
100	100	90–100	75–95	0. 06–0. 2	0. 08–0. 12	7. 9–8. 4	2–4	High	High	High.
100	100	90–100	70–80	0. 2–0. 6	0. 14–0. 17	7. 4–7. 8		High	High	High.
100	100	90–100	70–90	1. 2–2. 0	0. 19–0. 22	6. 6–7. 3		Low	Low	Low.
100	100	95–100	85–95	0. 2–0. 6	0. 16–0. 19	7. 4–7. 8		Moderate to high.	Moderate	Low.
100	100	95–100	85–95	0. 2–0. 6	0. 14–0. 17	7. 4–8. 4		Moderate to high.	Moderate	Low.
100	100	90–100	70–80	0. 06–0. 6	0. 17–0. 20	7. 9–8. 4		High	Moderate	Low.
100	100	90–100	70–80	0. 06–0. 6	0. 17–0. 20	7. 9–8. 4		High	Moderate	Low.
100	100	90–100	70–90	1. 2–2. 0	0. 19–0. 22	6. 6–7. 3		Low	Low	Low.
100	100	90–100	85–95	0. 6–1. 2	0. 19–0. 22	6. 6–7. 3		Moderate	Moderate	Low.
100	100	90–100	70–90	0. 6–1. 2	0. 17–0. 20	7. 4–7. 8		Moderate	Moderate	Low.
95–100	90–100	85–100	60–85	0. 6–2. 0	0. 17–0. 20	7. 9–8. 4		Low	Moderate	Low.
95–100	95–100	90–100	85–95	0. 6–2. 0	0. 17–0. 20	7. 4–8. 4		Low	Low	Low.
100	100	85–95	60–75	1. 2–2. 0	0. 19–0. 22	6. 6–7. 8		Low	Low	Low.
100	100	90–100	70–80	0. 6–1. 2	0. 19–0. 22	7. 4–7. 8		Moderate	High	Low.
100	100	90–100	70–80	0. 6–1. 2	0. 17–0. 20	7. 9–8. 4		Moderate	High	Low.
90–100	70–90	50–60	10–25	6. 0–10. 0	0. 06–0. 08	7. 9–8. 4		Low	Low	Low.
100	100	90–100	75–95	<0. 06	0. 10–0. 14	7. 4–7. 8		High	High	Low.
100	100	90–100	75–95	0. 06–0. 2	0. 08–0. 12	7. 9–8. 4		High	High	Moderate.

TABLE 4.—*Estimates of soil properties*

Soil series and map symbols	Depth to—		Depth from surface	Classification		
	Bedrock	Seasonal high water table		Dominant USDA texture	Unified	AASHO
	Ft.	*Ft.*	*In.*			
Kube Mapped only with Kadoka series.	>3½	>5	0–10	Silt loam	ML or ML–CL	A–4 or A–6
			10–17	Silty clay loam	CL	A–7 or A–6
			17–41	Silt loam	CL or ML–CL	A–6
			41–60	Siltstone.		
Kyle: Ky	>3½	>5	0–60	Clay	CH	A–7
*Lakoma: LaD, LdD, LdE For Murdo part of LaD, see Murdo series. For Samsil part of LdD and LdE, see Samsil series.	2–3½	>5	0–3	Clay	CH	A–7
			3–24	Clay	CH	A–7
			24–60	Shale.		
*Larvie: LeC, LfC, LhC, LmB For Conata part of LfC, see Conata series. For Hisle part of LhC, see Hisle series. For Metre part of LmB, see Metre series.	2–3½	>5	0–26	Clay	CH	A–7
			26–36	Shale.		
Lowry: LoA, LoB, Ls No valid estimates can be made for Slickspots part of Ls.	>5	>5	0–9	Silt loam	ML or ML–CL	A–4 or A–6
			9–60	Silt loam	ML or ML–CL	A–4 or A–6
*Manter: MaD, McE, MfC For Anselmo part of MaD, see Anselmo series. For Samsil part of McE, see Samsil series. For Tuthill part of MfC, see Tuthill series.	>5	>5	0–6	Fine sandy loam	SM	A–2 or A–4
			6–18	Sandy loam	SM	A–2 or A–4
			18–60	Loamy sand	SM	A–2
Metre Mapped only with Larvie series.	2–3½	>5	0–10	Clay	CH or MH	A–7
			10–30	Clay, silty clay	CH or MH	A–7
			30–60	Mudstone.		
*Millboro: MlB, MlC For Reliance part of MlB and MlC, see Reliance series.	>3½	>5	0–5	Silty clay	CH	A–7
			5–60	Clay	CH	A–7
Minatare: Mm	>5	3–6	0–1	Silt loam	ML or ML–CL	A–4
			1–12	Clay and silty clay loam	CH	A–7
			12–42	Silty clay loam, and clay loam.	CL	A–7 or A–6
			42–60	Stratified sand and clay	SM to CH	A–4 to A–7
Mitchell: Mn	>5	>5	0–28	Silt loam	ML or ML–CL	A–4 or A–6
			28–60	Very fine sandy loam	ML	A–4
Mosher: Mo	>5	>5	0–4	Silt loam	ML or ML–CL	A–4 or A–6
			4–21	Clay	CH or MH	A–7
			21–60	Silty clay	CH or MH	A–7
*Murdo: MrC, MsD, MuD For Lakoma part of MsD, see Lakoma series. For Schamber part of MuD, see Schamber series.	>5	>5	0–3	Gravelly loam	ML	A–4
			3–10	Gravelly clay loam	CL	A–6
			10–15	Gravelly clay loam	CL or ML–CL	A–6
			15–24	Gravelly sand	GM or SM	A–1 or A–2
			24–60	Sand and gravel	GC, GM, SC or SM.	A–1 or A–2
*Norrest: NlC, Nm, NoA, NoB, NrC, NsC, NsD, NtB. For Badland part of Nm, see Badland. For Blackpipe part of NoA and NoB, see Blackpipe series. For Cedar Butte part of NrC, see Cedar Butte series. For Imlay part of NsC and NsD, see Imlay series. For Okreek part of NtB, see Okreek series.	2–3½	>5	0–6	Silt loam	ML or ML–CL	A–6
			6–18	Silty clay loam	CL	A–7 or A–6
			18–32	Clay loam	CL	A–7 or A–6
			32–36	Siltstone.		

significant in engineering—Continued

Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)						Uncoated steel	Concrete
				In./hr.	*In./in. of soil*	*pH*	*Mmhos/cm.*			
100	100	90–100	70–90	1. 2–2. 0	0. 19–0. 22	6. 1–6. 5		Low	Low	Low.
100	100	95–100	85–95	0. 6–0. 2	0. 14–0. 17	6. 6–7. 3		Moderate	Moderate	Low.
100	100	90–100	70–90	0. 6–2. 0	0. 17–0. 20	6. 6–7. 8		Moderate	Low	Low.
100	100	95–100	90–100	<0. 06	0. 08–0. 12	7. 4–8. 4		High	High	Moderate.
100	100	90–100	80–95	0. 2–0. 6	0. 10–0. 14	7. 4–7. 8		High	High	Low.
100	100	90–100	75–95	0. 06–0. 2	0. 08–0. 12	7. 9–8. 4		High	High	Moderate.
100	100	90–100	75–95	<0. 06	0. 08–0. 12	7. 4–8. 4		High	High	High.
100	90–100	85–100	85–100	1. 2–2. 0	0. 19–0. 22	6. 6–7. 8		Low	Low	Low.
100	90–100	85–100	85–100	1. 2–2. 0	0. 17–0. 20	7. 4–8. 4		Low	Low	Low.
100	100	60–70	30–50	2. 0–6. 0	0. 14–0. 17	6. 6–7. 3		Low	Low	Low.
100	100	60–70	30–40	2. 0–6. 0	0. 09–0. 13	6. 6–7. 3		Low	Low	Low-
100	100	50–70	20–35	2. 0–6. 0	0. 08–0. 10	7. 4–7. 8		Low	Low	Low.
100	100	100	90–100	<0. 06	0. 10–0. 14	7. 4–8. 4		High	High	Low.
100	100	100	90–100	<0. 06	0. 08–0. 12	7. 9–8. 4		High	High	Low.
100	100	95–100	90–95	0. 2–0. 6	0. 13–0. 18	6. 6–7. 3		High	High	Low.
100	100	90–100	75–95	0. 06–0. 2	0. 08–0. 12	6. 6–8. 4		High	High	Moderate.
100	100	90–100	70–90	0. 06–1. 2	0. 17–0. 20	5. 6–7. 3		Low	Low	Low.
100	100	95–100	80–95	<0. 06	0. 05–0. 09	6. 6–8. 4	2–4	High	High	High.
100	95–100	90–100	70–95	0. 06–0. 6	0. 11–0. 14	7. 9–9. 0	2–4	Moderate	High	High.
95–100	90–100	70–95	40–90	0. 06–0. 2	0. 08–0. 12	7. 9–9. 4		Moderate	High	High.
100	100	90–100	70–90	1. 2–2. 0	0. 17–0. 20	7. 9–9. 0		Low	Low	Low.
100	100	80–95	50–70	1. 2–2. 0	0. 15–0. 17	8. 5–9. 0		Low	Low	Low.
100	100	90–100	70–90	1. 2–2. 0	0. 19–0. 22	6. 6–7. 3		Low	Low	Low.
100	100	90–100	75–95	<0. 06	0. 10 0. 15	6. 6–8. 4	2–4	High	High	Moderate.
100	100	95–100	90–95	0. 2–0. 6	0. 08–0. 13	7. 4–8. 4	2–4	High	High	High.
80–95	70–90	70–85	50–75	2. 0–6. 0	0. 18–0. 20	6. 6–7. 3		Low	Low	Low.
70–90	60–90	60–85	50–85	2. 0–6. 0	0. 19–0. 22	6. 6–7. 3		Low	Low	Low.
60–80	50–80	50–75	50–70	2. 0–6. 0	0. 17–0. 20	6. 6–7. 3		Low	Low	Low.
50–75	40–60	20–50	10–35	6. 0–10. 0	0. 06–0. 08	7. 4–7. 8		Low	Low	Low.
50–75	40–60	20–50	5–25	6. 0–10. 0	0. 03–0. 06	7. 4–7. 8		Low	Low	Low.
100	100	90–100	70–90	0. 6–1. 2	0. 17–0. 20	7. 9–8. 4		Low	Low	Low.
100	100	95–100	85–95	0. 2–0. 6	0. 14–0. 17	7. 9–8. 4		Moderate	Moderate	Low.
100	100	90–100	70–80	0. 2–0. 6	0. 17–0. 20	7. 9–8. 4		Moderate	Moderate	Low.

TABLE 4.—*Estimates of soil properties*

Soil series and map symbols	Depth to—		Depth from surface	Classification		
	Bedrock	Seasonal high water table		Dominant USDA texture	Unified	AASHO
	Ft.	*Ft.*	*In.*			
Okreek	2–3½	>5	0–7	Silty clay	CH	A–7
			7–25	Clay	CH	A–7
Mapped only with Norrest soils.			25–30	Silty clay	CH	A–7
			30–40	Siltstone.		
*Opal: OcC, OgC, OlB, OlC, OmB, OpB, OtB, OtD, OwC.	2–3½	>5	0–8	Clay	CH	A–7
			8–34	Clay	CH	A–7
For Caputa part of OlB and OlC, see Caputa series. For Mosher part of OmB, see Mosher series. For Promise part of OpB, see Promise series. For Tuthill part of OtB and OtD, see Tuthill series. For Woodly part of OwC, see Woodly series.			34–40	Shale.		
*Orella: Ox	<2	>5	0–1	Silt loam	ML or ML–CL	A–4 or A–6
			1–13	Clay	CH	A–7
For Badland part of Ox, see Badland.			13–60	Shale.		
*Promise: PcA, PcB, Pd, PgA, PgB, PmA, Ps.	>3½	>5	0–13	Clay	CH	A–7
			13–60	Clay	CH	A–7
For Opal part of PgA and PgB, see Opal series. For Mosher part of PmA, see Mosher series. No valid estimates can be made for Slickspots part of Ps.						
*Ree: ReB, RkA, RkB	>5	>5	0–7	Loam	ML or ML–CL	A–4 or A–6
			7–14	Clay loam	CL	A–6
For Keya part of RkA and RkB, see Keya series.			14–30	Clay loam	CL	A–6
			30–40	Loam	CL or ML–CL	A–4 or A–6
			40–60	Fine sandy loam	SM	A–4
Reliance	>5	>5	0–5	Silty clay loam	CL	A–6 or A–7
			5–14	Silty clay	CH or MH	A–7
Mapped only with Millboro soils.			14–50	Silty clay, clay	CH or MH	A–7
			50–60	Clay loam	CL	A–6 or A–7
*Samsil: SaE, SlD, SlE, SmE, SnE, Ss	<2	>5	0–17	Clay	CH	A–7
			17–28	Shale.		
For Lakoma part of SlD and SlE, see Lakoma series. For Manter part of SmE, see Manter series. For Schamber part of SnE, see Schamber series. No valid estimates can be made for Shale outcrop part of Ss.						
Sandy land: St.						
No valid estimates can be made.						
Savo: SuA, SuB, SuC	>5	>5	0–10	Silty clay loam	ML–CL or CL	A–6
			10–58	Silty clay loam	CL or CH	A–6 or A–7
			58–60	Sand and gravel	GM	A–1
*Schamber: SvE, SwE	>5	>5	0–6	Gravelly loam	ML	A–4
			6–60	Sand and gravel	GM	A–1 or A–2
For Murdo part of SvE, see Murdo series. For Samsil part of SwE, see Samsil series.						
Stirk: Sy	>5	>5	0–60	Clay	CH or MH	A–7

significant in engineering—Continued

Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)						Uncoated steel	Concrete
				In./hr.	*In./in. of soil*	*pH*	*Mmhos/cm.*			
100	100	90–100	90–95	0. 2–0. 6	0. 13–0. 18	6. 6–7. 3		High	High	Low.
100	100	90–100	90–100	0. 06–0. 2	0. 08–0. 12	6. 6–8. 4		High	High	Low.
100	100	90–100	90–95	0. 06–0. 6	0. 08–0. 12	7. 9–8. 4		High	High	Low.
100	100	90–100	85–100	<0. 06	0. 10–0. 14	7. 4–7. 8		High	High	Low.
100	100	90–100	90–100	<0. 06	0. 08–0. 12	7. 4–8. 4		High	High	Moderate.
100	100	90–100	70–90	0. 6–1. 2	0. 17–0. 20	6. 6–7. 3		Low	Low	Low.
100	100	90–100	75–100	<0. 06	0. 08–0. 12	8. 5–9. 0	2–6	High	High	Low.
100	100	90–100	80–100	0. 02–0. 2	0. 10–0. 14	7. 4–7. 8		High	High	Low.
100	100	90–100	80–100	0. 02–0. 2	0. 08–0. 12	7. 4–8. 4		High	High	Moderate.
100	100	80–100	70–95	1. 2–2. 0	0. 18–0. 20	6. 6–7. 3		Low	Low	Low.
100	90–100	80–100	60–90	0. 6–1. 2	0. 19–0. 22	7. 4–7. 8		Moderate	Moderate	Low.
100	85–100	70–100	60–90	0. 6–1. 2	0. 17–0. 20	7. 4–7. 8		Moderate	Moderate	Low.
100	85–100	70–100	60–75	0. 6–2. 0	0. 16–0. 18	7. 9–8. 4		Low	Moderate	Low.
100	85–100	70–85	40–50	1. 2–6. 0	0. 12–0. 15	7. 9–8. 4		Low	Low	Low.
100	100	95–100	85–95	0. 6–1. 2	0. 19–0. 22	6. 6–7. 3		Moderate	Moderate	Low.
100	100	95–100	90–95	0. 2–0. 6	0. 13–0. 18	7. 4–7. 8		High	High	Low.
100	100	95–100	90–95	0. 2–0. 6	0. 11–0. 16	7. 9–8. 4		High	High	Low.
100	100	90–100	75–95	0. 2–0. 6	0. 14–0. 17	7. 9–8. 4		Moderate	High	Low.
100	100	90–100	75–95	0. 06–0. 2	0. 08–0. 12	7. 4–8. 4		High	High	Moderate.
100	100	90–100	70–90	0. 6–1. 2	0. 19–0. 22	6. 6–7. 3		Moderate	Moderate	Low.
100	100	95–100	85–95	0. 2–0. 6	0. 16–0. 19	6. 6–8. 4		Moderate to high.	Moderate	Low.
30–60	20–50	10–40	5–15	6. 0–10. 0	0. 03–0. 06	7. 9–8. 4		Low	Moderate	Low.
80–100	70–100	60–75	50–65	6. 0–10. 0	0. 16–0. 18	6. 6–8. 4		Low	Low	Low.
35–70	25–60	15–50	5–30	6. 0–10. 0	0. 03–0. 06	7. 9–8. 4		Low	Low	Low.
100	100	90–100	75–95	0. 02–0. 2	0. 08–0. 12	7. 9–8. 4		High	High	Moderate.

TABLE 4.—*Estimates of soil properties*

Soil series and map symbols	Depth to—		Depth from surface	Classification		
	Bedrock	Seasonal high water table		Dominant USDA texture	Unified	AASHO
	Ft.	*Ft.*	*In.*			
*Tuthill: ThB, ToC, TuB, TwA, TwB—For Opal part of ToC, see Opal series. For Whitelake part of TuB, see Whitelake series. For Woodly part of TwA and TwB, see Woodly series.	>5	>5	0–8	Fine sandy loam	SM or ML	A–4
			8–24	Sandy clay loam	SC or CL	A–4 or A–6
			24–39	Sandy loam	SM	A–2 or A–4
			39–60	Loamy sand	SM	A–2
Valentine: VaE	>5	>5	0–60	Fine sand	SM or SP-SM	A–2 or A–3
*Wanblee: Wa, WbB—For Whitelake part of Wa, see Whitelake series. For Wortman part of WbB, see Wortman series.	1½–3	>5	0–1	Silt loam	ML or ML-CL	A–4 or A–6
			1–3	Silty clay loam	CL	A–6 or A–7
			3–20	Silty clay loam	CL	A–6 or A–7
			20–40	Siltstone.		
Whitelake—Mapped only with Tuthill and Wanblee soils.	>3½	>5	0–10	Fine sandy loam	SM	A–2 or A–4
			10–16	Fine sandy loam	SM	A–2 or A–4
			16–24	Sandy loam	SM	A–2
			24–60	Silty clay loam	CL or CL-ML	A–4 or A–6
*Woodly: Wd, WoB—For Opal part of WoB, see Opal series.	>5	>5	0–21	Fine sandy loam	SM or ML	A–2 or A–4
			21–33	Sandy clay loam	SC or CL	A–6
			33–40	Sandy clay loam	SC or CL	A–6
			40–60	Sandy loam	SM	A–2 or A–4
*Wortman: Ww—For Wanblee part of Ww, see Wanblee series.	1½–3	>5½	0–5	Silt loam	ML or ML-CL	A–4 or A–6
			5–7	Silty clay loam	CL or CH	A–7
			7–11	Silty clay loam	CL	A–7
			11–36	Silty clay loam	CL	A–6 or A–7
			36–60	Siltstone.		

significant in engineering—Continued

Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)						Uncoated steel	Concrete
100	100	70–85	40–55	2. 0–6. 0	0. 14–0. 17	6. 6–7. 3		Low	Low	Low.
100	100	80–90	35–55	0. 6–1. 2	0. 16–0. 18	6. 6–7. 3		Moderate	Moderate	Low.
100	100	60–70	30–40	2. 0–6. 0	0. 09–0. 13	6. 6–7. 8		Low	Low	Low.
100	100	50–70	15–35	6. 0–20. 0	0. 08–0. 10	6. 6–7. 8		Low	Low	Low.
100	100	65–80	5–20	6. 0–10. 0	0. 06–0. 08	6. 6–7. 3		Low	Low	Low.
100	100	90–100	70–90	1. 2–2. 0	0. 19–0. 22	7. 9–8. 4	2–4	Low	Low	Low.
100	100	95–100	85–95	0. 06–0. 2	0. 13–0. 16	8. 5–9. 0	2–4	High	High	Moderate.
100	100	95–100	85–95	0. 06–0. 2	0. 11–0. 14	8. 5–9. 0	2–4	High	High	High.
100	100	70–85	30–50	2. 0–6. 0	0. 14–0. 17	7. 4–8. 4		Low	Low	Low.
100	100	70–85	30–50	2. 0–6. 0	0. 12–0. 15	8. 5–9. 0		Low	Moderate	Moderate.
100	95–100	60–70	20–35	0. 06–0. 6	0. 08–0. 12	8. 5–9. 0	2–4	Moderate	Moderate	Moderate.
100	100	95–100	80–95	0. 2–0. 6	0. 17–0. 20	8. 5–9. 0	2–4	Moderate	Moderate	High.
100	100	70–85	30–55	2. 0–6. 0	0. 14–0. 17	6. 6–7. 3		Low	Low	Low.
100	100	80–90	35–55	0. 6–1. 2	0. 18–0. 20	6. 6–7. 3		Low to moderate.	Moderate	Low.
100	100	80–90	35–55	0. 6–1. 2	0. 16–0. 18	6. 6–7. 3		Low to moderate.	Moderate	Low.
100	100	60–70	30–40	2. 0–6. 0	0. 09–0. 13	6. 6–7. 3		Low	Moderate	Low.
100	100	90–100	70–90	0. 6–2. 0	0. 19–0. 22	6. 6–7. 8		Low	Low	Low.
100	100	95–100	85–95	<0. 06	0. 11–0. 14	7. 9–8. 4	2–4	High	High	Moderate.
100	100	95–100	85–95	0. 06–0. 2	0. 11–0. 14	8. 5–9. 0	2–4	High	High	Moderate.
100	100	95–100	85–95	0. 6–1. 2	0. 14–0. 17	7. 9–9. 0		Moderate to high.	High	High.

TABLE 5.—*Engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soils. The soils for referring to other series that appear

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary land fill[1]	Local roads and streets
Altvan: AlC	Slight[2]	Severe: rapid permeability in substratum.	Severe: sloughing below a depth of 2 feet in underlying sand and gravel.	Moderate: moderate shrink-swell potential.	Severe: rapid permeability below a depth of 2 feet; upper part good cover material.	Moderate: moderate shrink-swell potential in subsoil.
Anselmo Mapped only with Dunday and Manter soils.	Slight if slope is less than 9 percent, moderate if 9 to 15 percent.[2]	Severe: moderately rapid permeability.	Severe: fine sand substratum.	Slight if slope is less than 9 percent, moderate if 9 to 15 percent.	Severe: moderately rapid permeability.	Slight if slope is less than 9 percent, moderate if 9 to 15 percent.
Badland: Ba. No interpretations; material too variable.						
*Bankard: Bg For Glenberg part of Bg, see Glenberg series.	Severe: subject to flooding.	Severe: rapid permeability; subject to flooding.	Severe: sandy texture; subject to flooding.	Severe: flood hazard.	Severe: flood hazard; rapid permeability.	Severe: subject to flooding.
Barren badland: Bk. No interpretations; material too variable.						
Blackpipe: Bp	Severe: less than 40 inches deep over shale.	Severe: less than 40 inches deep over shale.	Slight: dominantly silty clay loam texture; bedrock rippable.	Severe: high shrink-swell potential.	Moderate: silty clay loam texture.	Severe: high shrink-swell potential.
*Buffington: Br, Bs, Bt, Bu, Bv, Bw, Bx. For Minatare part of Bx, see Minatare series.	Moderate: moderately slow permeability; some areas subject to flooding.	Slight to severe: some areas subject to flooding.	Slight to severe: some areas subject to flooding.	Moderate to severe: some areas subject to flooding; moderate to high shrink-swell potential.	Moderate to severe: silty clay loam texture; some areas subject to flooding.	Severe: moderate to high shrink-swell potential; some areas subject to flooding; plasticity index greater than 15.
Caputa: CaB, CaC	Moderate: moderately slow permeability.	Slight if slope is less than than 2 percent, moderate if 2 to 6 percent, severe if more than 6 percent.	Moderate: clay loam texture.	Severe: moderate to high shrink-swell potential.	Moderate: clay loam texture.	Severe: moderate to high shrink-swell potential; plasticity index greater than 15.

interpretations

in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions in the first column of this table]

Suitability as a source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
Fair in upper part: moderate shrink-swell potential. Good below 2 feet.	Fair to poor: more than 10 percent fines or plastic material.	Good in top 7 inches. Fair to a depth of 28 inches: clay loam texture.	Rapid permeability below a depth of 2 feet: high seepage.	Fair to good stability; low to moderate permeability if compacted.	Rapid permeability in substratum.	Low to medium available water capacity; sand and gravel at moderate depths.	Sand and gravel at a depth of 20 to 40 inches.
Good	Poor: sand more than 15 percent fines.	Fair: subject to soil blowing; 16 inches thick; fine sand below.	Moderately rapid permeability; high seepage.	Good stability; fair to good compaction characteristics; poor resistance to piping.	Moderately rapid permeability; fine sand substratum.	Low to medium available water capacity; subject to soil blowing; moderately rapid water intake rate.	Moderately rapid permeability; subject to soil blowing.
Good	Fair to poor: fine sand.	Poor: blows easily; loamy very fine sand texture.	Rapid permeability; high seepage.	Sandy material; potential seepage; poor resistance to piping.	Rapid permeability.	Low available water capacity; rapid water intake rate; subject to soil blowing.	(3).
Poor: high shrink-swell potential.	Unsuitable: no sand and gravel.	Fair: 8 to 16 inches thick; silty clay loam texture.	20 to 40 inches deep over shale; possible seepage.	High shrink-swell potential; fair to poor stability and compaction characteristics; medium to high compressibility.	Moderate depth over shale.	Low to medium available water capacity; moderately slow permeability; slow water intake rate.	20 to 40 inches deep over shale; moderately slow permeability.
Poor: moderate to high shrink-swell potential; plasticity index greater than 15.	Unsuitable: no sand and gravel.	Fair: silty clay loam texture.	Moderate permeability in substratum; possible seepage.	Fair to good stability; medium to high compressibility.	Some areas subject to flooding; moderately slow permeability.	High available water capacity; slow water intake rate; moderately slow permeability.	(3).
Poor: moderate to high shrink-swell potential; plasticity index greater than 15.	Unsuitable in most areas: gravel below a depth of 4 feet in some areas.	Fair: loam and clay loam textures.	Moderately slow permeability; possible coarse-textured material in substratum.	Fair stability and compaction characteristics; medium to high compressibility.	Moderately slow permeability.	High available water capacity; moderately slow water intake rate.	Mostly long, smooth slopes; moderately slow permeability.

TABLE 5.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary land fill[1]	Local roads and streets
Cedar Butte: Ce	Severe: slow to very slow permeability.	Slight to moderate: substratum ranges from sand to shale between a depth of 40 and 60 inches.	Severe: clay and silty clay texture.	Severe: high shrink-swell potential.	Severe: clay and silty clay textures.	Severe: high shrink-swell potential.
*Conata: CIE. For Larvie part of CIE, see Larvie series.	Severe: very slow permeability; less than 20 inches deep over mudstone.	Severe: less than 20 inches deep over mudstone; slopes are greater than 6 percent.	Severe: clay texture.	Severe: clay texture; high shrink-swell potential; bedrock at a depth of less than 20 inches.	Severe: clay texture; mudstone at a depth of less than 20 inches.	Severe: high shrink-swell potential.
*Dunday: DsC, DtB, DuD. For Anselmo part of DtB, see Anselmo series. For Valentine part of DuD, see Valentine series.	Slight[2]	Severe: rapid permeability.	Severe: sloughing; sandy texture.	Slight	Severe: rapid permeability; poor cover material.	Slight
*Duroc: DvA, DvB. For Kadoka part of DvA and DvB, see Kadoka series.	Moderate: moderate permeability.	Moderate: moderate permeability.	Slight to moderate: moderately well drained to well drained.	Moderate: moderate shrink-swell potential.	Moderate: silty clay loam texture.	Severe: moderate shrink-swell potential; plasticity index greater than 15.
*Epping: EhD, EhE. For Huggins part of EhD and EhE, see Huggins series.	Severe: less than 20 inches deep over siltstone.	Severe: shallow over siltstone; slope.	Moderate if slope is less than 15 percent, severe if 15 to 40 percent; less than 20 inches deep over siltstone; siltstone rippable.	Moderate if slope is less than 15 percent, severe if 15 to 40 percent; less than 20 inches deep over siltstone; siltstone rippable.	Slight if slope is less than 15 percent, moderate if 15 to 25 percent, severe if less than 25 percent; siltstone rippable.	Moderate if slope is 9 to 15 percent, severe if greater than 15 percent.
Glenberg: Ge	Slight to severe: some areas subject to flooding.	Severe: moderately rapid permeability; flood hazard in some areas.	Moderate: some areas subject to flooding; sloughing in substratum.	Slight to severe: some areas subject to flooding.	Severe: moderately rapid permeability; some areas subject to flooding.	Slight to severe: some areas subject to flooding.

interpretations—Continued

Suitability as a source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
Poor: high shrink-swell potential.	Unsuitable: no sand and gravel.	Poor: 6 inch surface layer over compact subsoil.	Low seepage; gravelly substratum and shale in some profiles.	Fair to poor stability and compaction characteristics; high compressibility.	Slow to very slow permeability; claypan subsoil.	Unsuitable: claypan subsoil; high sodium content.	Slow to very slow permeability; claypan subsoil.
Poor: high shrink-swell potential; some slopes greater than 25 percent.	Unsuitable: no sand or gravel.	Poor: clay texture.	Mudstone at a depth of less than 20 inches; very slow permeability.	Fair to poor stability and compaction characteristics; limited material over mudstone.	Very slow permeability; shallow over mudstone.	Unsuitable: shallow over mudstone; slope.	Shallow over mudstone; very slow permeability.
Good	Poor for sand: more than 15 percent fines; no gravel.	Poor: blows easily; loamy fine sand texture.	Rapid permeability.	Fair to good compaction characteristics; poor resistance to piping.	Rapid permeability.	Low available water capacity; very rapid water intake rate; subject to soil blowing.	Rapid permeability; subject to soil blowing.
Poor: moderate shrink-swell potential; plasticity index greater than 15.	Unsuitable: no sand or gravel.	Good to a depth of 13 inches. Fair below: silty clay loam texture.	Moderate permeability.	Fair to good stability and compaction characteristics; moderate shrink-swell potential.	Moderate permeability.	Medium to high available water capacity; moderately slow water intake rate.	Bedrock between a depth of 40 and 60 inches in places.
Fair to poor: some slopes over 25 percent; ML material.	Unsuitable: no sand or gravel.	Poor: less than 20 inches deep over bedrock; slope.	Shallow over siltstone; possible high seepage; 5 to 40 percent slopes.	Limited material over siltstone; poor stability; poor resistance to piping.	Shallow over siltstone.	Unsuitable: shallow over siltstone; slope.	Shallow over siltstone; 5 to 40 percent slopes.
Good to fair: 20 to 60 percent fines.	Poor for sand: more than 15 percent fines; no gravel.	Good, but low fertility.	Rapid permeability in substratum.	Good stability; fair to good compaction characteristics; poor resistance to piping.	Rapid permeability in substratum; some areas subject to flooding.	Medium to high available water capacity; moderately rapid water intake rate; subject to soil blowing.	[3].

TABLE 5.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary land fill[1]	Local roads and streets
Haverson: Ha, Hc, Hd, He.	Moderate: moderate permeability. Severe in areas subject to flooding.	Severe: rapid permeability in substratum; some areas subject to flooding.	Slight to severe: some areas subject to flooding.	Slight to severe: some areas subject to periodic flooding.	Slight to severe: some areas subject to flooding.	Moderate to severe: CL material; some areas subject to flooding.
*Hisle: HID. For Orella part of HID, see Orella series.	Severe: very slow permeability; less than 40 inches deep over shale.	Severe: less than 40 inches deep over shale.	Severe: silty clay texture.	Severe: silty clay texture; high shrink-swell potential.	Severe: silty clay texture.	Severe: high shrink-swell potential.
Hoven. Mapped only with Kolls soils.	Severe: very slow permeability; frequent flooding.	Severe: frequent flooding.	Severe: frequent flooding.	Severe: frequent flooding; high shrink-swell potential.	Severe: clay texture; frequent flooding.	Severe: frequent flooding; high shrink-swell potential; AASHO group index greater than 8.
*Huggins: HnB, HnC, HpD, HuA, HuB, HwB. For Epping part of HpD, see Epping series. For Kadoka part of HuA and HuB, see Kadoka series. For Wortman part of HwB, see Wortman series.	Severe: less than 40 inches deep over siltstone.	Severe: siltstone at a depth of 20 to 40 inches.	Severe: siltstone at a depth of 20 to 40 inches; some areas rippable.	Moderate to severe: siltstone at a depth of 20 to 40 inches; siltstone rippable in places.	Moderate to severe: siltstone rippable in places.	Moderate: siltstone at a depth of 20 to 40 inches; moderate to high shrink-swell potential.
*Imlay: Ib, IcD, IcE, InE. For Badland part of Ib, see Badland. For Conata part of IcD and IcE, see Conata series. For Norrest part of InE, see Norrest series.	Severe: less than 20 inches deep over siltstone.	Severe: shallow over siltstone.	Moderate if slope is less than 15 percent, severe if greater than 15 percent; shallow over siltstone; siltstone rippable.	Severe: high shrink-swell potential.	Moderate if slope is less than 25 percent, severe if greater than 25 percent.	Severe: high shrink-swell potential.
*Kadoka: Ka. For Kube part of Ka, see Kube series.	Severe: less than 40 inches deep over siltstone.	Severe: siltstone at a depth of 20 to 40 inches.	Moderate: less than 40 inches deep over siltstone; siltstone rippable.	Moderate: moderate shrink-swell potential; siltstone rippable.	Moderate: less than 40 inches deep over siltstone; siltstone rippable.	Severe: moderate shrink-swell potential; siltstone rippable; AASHO group index greater than 8.

interpretations—Continued

Suitability as a source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
Fair: moderate shrink-swell potential; CL material.	Unsuitable: possible source of sand and gravel below a depth of 4 feet in places.	Good to poor: fine textured surface layer; in places low fertility.	Moderate permeability.	Fair to good stability and compaction characteristics.	Moderate permeability; some areas subject to flooding.	High available water capacity; moderate water intake rate; some areas subject to flooding.	(3).
Poor: high shrink-swell potential.	Unsuitable: no sand or gravel.	Poor: surface layer 1 inch deep over claypan subsoil.	Very slow permeability; shale at a depth of less than 40 inches in most areas.	Fair to poor stability and compaction characteristics; limited material over shale.	Very slow permeability; moderate depth over shale; claypan subsoil.	Claypan subsoil; high in sodium content.	Very slow permeability; shale at moderate depths; claypan subsoil.
Poor: poorly drained; high shrink-swell potential.	Unsuitable: no sand or gravel.	Poor: clay texture; poorly drained.	Good dugout site in most areas.	Fair to poor stability and compaction characteristics; high compressibility.	Wet areas usually lower than available outlets; very slow permeability.	Poorly drained; claypan subsoil.	(3).
Poor: limited material over bedrock; moderate to high shrink-swell potential.	Unsuitable: no sand or gravel.	Poor to fair: upper 7 inches is fair.	Possible seepage; siltstone at a depth of 20 to 40 inches.	Limited soil material; fair to poor stability and compaction characteristics.	Moderate depth over siltstone.	Low available water capacity; moderately slow permeability; siltstone at a depth of 20 to 40 inches.	Siltstone at moderate depths.
Poor: high shrink-swell potential.	Unsuitable: no sand or gravel.	Poor: less than 20 inches deep over siltstone.	Less than 20 inches deep over siltstone; possible seepage.	Limited soil material; fair to good stability; medium to high compressibility.	Shallow over siltstone.	Shallow over siltstone; slope.	Shallow over siltstone; short steep slopes.
Poor: moderate shrink-swell potential; AASHO group index greater than 8.	Unsuitable: no sand or gravel.	Good in top 7 inches. Fair below: silty clay loam texture.	Siltstone at a depth of 20 to 40 inches; possible seepage.	Fair to poor stability and compaction characteristics; potential piping; medium to high compressibility.	Moderate depth over siltstone.	Low to medium available water capacity; moderately slow water intake rate.	Moderate permeability; siltstone at moderate depths.

TABLE 5.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary land fill[1]	Local roads and streets
*Keota: KeD---- For Epping part of KeD, see Epping series.	Severe: less than 40 inches deep over siltstone.	Severe: siltstone at a depth of 20 to 40 inches.	Moderate: less than 40 inches deep over siltstone; siltstone rippable.	Moderate: less than 40 inches deep over siltstone; siltstone rippable.	Moderate: less than 40 inches deep over siltstone; siltstone rippable.	Severe: more than 9 percent slopes; ML material; AASHO group index greater than 8.
Keya---- Mapped only with Ree soils.	Moderate to severe: moderate permeability; subject to run-in water in places.	Severe: rapid permeability in substratum.	Moderate to severe: moderately well drained; subject to run-in water in places.	Moderate to severe: subject to run-in water in places; moderate shrink-swell potential.	Moderate to severe: clay loam texture; subject to run-in water in places.	Moderate to severe: moderate shrink-swell potential; subject to run-in water in places.
*Kolls: Kh---- For Hoven part of Kh, see Hoven series.	Severe: very slow permeability; frequent flooding.	Severe: frequent flooding.	Severe: frequent flooding.	Severe: frequent flooding; high shrink-swell potential.	Severe: clay texture; frequent flooding.	Severe: frequent flooding; high shrink-swell potential.
Kube---- Mapped only with Kadoka soils.	Moderate to severe: moderate permeability; less than 48 inches deep over siltstone in some areas.	Moderate: moderate permeability; 40 to 60 inches deep over bedrock.	Slight: rippable siltstone below a depth of 40 inches.	Moderate: low to moderate shrink-swell potential; 40 to 60 inches deep over rippable siltstone.	Moderate: silt loam and silty clay loam texture; 40 to 60 inches deep over rippable siltstone.	Severe: moderate shrink-swell potential; AASHO group index greater than 8.
Kyle: Ky----	Severe: very slow permeability.	Moderate: 2 to 6 percent slopes.	Severe: clay texture.	Severe: high shrink-swell potential.	Severe: clay texture.	Severe: high shrink-swell potential.
*Lakoma: LaD, LdD, LdE For Murdo part of LaD, see Murdo series. For Samsil part of LdD and LdE, see Samsil series.	Severe: slow permeability; less than 40 inches deep over shale.	Severe: less than 40 inches deep over shale.	Severe: clay texture.	Severe: high shrink-swell potential.	Severe: clay texture.	Severe: high shrink-swell potential.

See footnotes at end of table.

interpretations—Continued

Suitability as a source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
Poor: limited soil material over bedrock; ML material; AASHO group index greater than 8.	Unsuitable: no sand or gravel.	Fair: limited material; 20 to 40 inches deep over bedrock.	Seepage potential in siltstone.	Poor stability and compaction characteristics; poor resistance to piping.	Moderate depth over siltstone.	Sloping areas; low available water capacity; moderately slow water intake rate.	Siltstone at moderate depths; 9 to 15 percent slopes.
Fair: moderate shrink-swell potential.	Possible source below a depth of 4 feet.	Good to a depth of 16 inches. Fair below: clay loam texture.	Possible rapidly permeable material in substratum.	Fair to poor stability and compaction characteristics; moderate shrink-swell potenpotential.	Moderate permeability.	High available water capacity; moderately slow water intake rate.	[3].
Poor: poorly drained; high shrink-swell potential.	Unsuitable: no sand or gravel.	Poor: clay texture; poorly drained.	Good dugout site in most areas.	Fair to poor stability and compaction characteristics; high compressibility.	Wet areas usually lower than available outlets; very slow permeability.	Poorly drained; very slow water intake rate.	[3].
Poor: moderate shrink-swell potential; AASHO group index greater than 8.	Unsuitable: no sand or gravel.	Good to a depth of 10inches. Fair below: silty clay loam texture.	Possible seepage below a depth of 40 inches.	Fair to poor stability and compaction characteristics; subject to piping; medium to high compressibility.	Moderate permeability.	High available water capacity; slow water intake rate.	Moderate permeability.
Poor: high shrink-swell potential.	Unsuitable: no sand or gravel.	Poor: clay texture.	Low seepage; very slow permeability.	High volume changes; fair to poor stability and compaction characteristics; high compressibility.	Very slow permeability.	Low to medium available water capacity; very slow water intake rate.	Very slow permeability; long, smooth slopes.
Poor: high shrink-swell potential.	Unsuitable: no sand or gravel.	Poor: clay texture.	Shale at a depth of 20 to 40 inches; possible seepage in shale fractures.	High shrink-swell potential; fair to poor stability and compaction characteristics; high compressibility.	Slow permeability; moderate depth over shale.	Slope	Slow permeability; shale at moderate depths; slope ranges up to 40 percent.

TABLE 5.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary land fill[1]	Local roads and streets
*Larvie: LeC, LfC, LhC, LmB. For Conata part of LfC, see Conata series. For Hisle part of LhC, see Hisle series. For Metre part of LmB, see Metre series.	Severe: very slow permeability; less than 40 inches deep over shale.	Severe: shale or mudstone at a depth of 20 to 40 inches.	Severe: clay texture.	Severe: high shrink-swell potential.	Severe: clay texture.	Severe: high shrink-swell potential.
Lowry: LoA, LoB, Ls. No interpretations for Slickspots part of Ls, material too variable.	Slight	Moderate: moderate permeability.	Slight	Moderate: ML material.	Slight	Moderate: AASHO group index of 5 to 8.
*Manter: MaD, McE, MfC. For Anselmo part of MaD, see Anselmo series. For Samsil part of McE, see Samsil series. For Tuthill part of MfC, see Tuthill series.	Moderate if slope is less than 15 percent, severe if greater than 15 percent.[2]	Severe: moderately rapid permeability.	Severe: sandy substratum.	Slight to moderate if slope is less than 15 percent, severe if more than 15 percent.	Severe: moderately rapid permeability.	Slight to moderate if slope is less than 15 percent, severe if more than 15 percent.
Metre. Mapped only with Larvie soils.	Severe: very slow permeability; less than 40 inches deep over shale.	Severe: mudstone at a depth of 20 to 40 inches.	Severe: clay texture.	Severe: high shrink-swell potential.	Severe: clay texture.	Severe: high shrink-swell potential.
*Millboro: MIB, MIC. For Reliance part of MIB, and MIC, see Reliance series.	Severe: slow permeability.	Moderate if slope is 2 to 6 percent, severe if more than 6 percent.	Severe: clay texture.	Severe: high shrink-swell potential.	Severe: clay texture.	Severe: high shrink-swell potential.
Minatare: Mm	Severe: very slow permeability.	Moderate: temporary water table in spring.	Severe: moderately well drained to somewhat poorly drained; sand and gravel substratum; claypan subsoil.	Severe: high shrink-swell potential.	Severe: clayey texture; poor cover material.	Severe: high shrink-swell potential.

See footnotes at end of table.

interpretations—Continued

Suitability as a source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
Poor: high shrink-swell potential.	Unsuitable: no sand or gravel.	Poor: clay texture.	Bedrock at a depth of 20 to 40 inches; possible seepage; very slow permeability.	Limited soil material; high volume change; fair to poor compaction characteristics; high compressibility.	Very slow permeability; bedrock at a depth of 20 to 40 inches.	Low to very low available water capacity; very slow water intake rate; most slopes unsuitable.	Very slow permeability; bedrock at a depth of 20 to 40 inches.
Moderate: AASHO group index of 5 to 8; ML material.	Unsuitable: no sand or gravel.	Good	Moderate permeability; seepage possible.	Poor stability and compaction characteristics; moderate permeability if compacted; poor resistance to piping.	Moderate permeability.	High available water capacity; moderate water intake rate; deep rooting zone.	Moderate permeability.
Good	Poor for sand: more than 15 percent fines; no gravel.	Good to a depth of 18 inches; loamy sand below.	Moderately rapid permeability.	Good stability; fair to good compaction characteristics; possible piping.	Moderately rapid permeability.	Slopes greater than 9 percent; moderate water intake rate.	Moderately rapid permeability; 9 to 25 percent slopes; subject to soil blowing.
Poor: high shrink-swell potential.	Unsuitable: no sand or gravel.	Poor: clay texture.	Mudstone at a depth of 20 to 40 inches; very slow permeability.	Fair to poor stability and compaction characteristics; high to very high compressibility; high volume change.	Very slow permeability; moderate depth over mudstone.	Low to very low available water capacity; very slow water intake rate; 20 to 40 inches deep over mudstone.	Very slow permeability; mudstone at a depth of 20 to 40 inches.
Poor: high shrink-swell potential.	Unsuitable: no sand or gravel.	Poor: clay texture.	Slow permeability; low seepage.	Fair to poor stability and compaction characteristics; high compressibility; high volume change.	Slow permeability.	Low to medium available water capacity; very slow water intake rate.	Slow permeability; long, smooth slopes.
Poor: high shrink-swell potential.	Unsuitable: possible source below a depth of 40 inches; temporary water table.	Poor: 1 inch surface layer; claypan subsoil below.	Very slow permeability in upper part; possible seepage in substratum.	Fair to poor stability and compaction characteristics; high compressibility.	Very slow permeability.	Claypan subsoil; high in sodium.	Very slow permeability; difficult to grow plants.

TABLE 5.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary land fill [1]	Local roads and streets
Mitchell: Mn	Slight	Moderate: moderate permeability.	Slight	Moderate: ML material.	Slight	Moderate: AASHO group index of 5 to 8; ML material.
Mosher: Mo	Severe: very slow permeability.	Slight if slope is less than 2 percent, moderate if 2 to 6 percent.	Severe: clay texture.	Severe: high shrink-swell potential.	Severe: clay texture; poor cover material and workability.	Severe: high shrink-swell potential.
*Murdo: MrC, MsD, MuD. For Lakoma part of MsD, see Lakoma series. For Schamber part of MuD, see Schamber series.	Slight to moderate: moderate if slope is greater than 8 percent.[2]	Severe: rapid permeability below a depth of 15 inches.	Severe: sloughing; sand and gravel substratum.	Slight if slope is less than 9 percent, moderate if 9 to 15 percent.	Severe: rapid permeability in substratum; poor cover material.	Slight if slope is less than 9 percent, moderate if 9 to 15 percent.
*Norrest: NlC, Nm, NoA, NoB, NrC, NsC, NsD, NtB. For Badland part of Nm, see Badland. For Blackpipe part of NoA and NoB, see Blackpipe series. For Cedar Butte part of NrC, see Cedar Butte series. For Imlay part of NsC and NsD, see Imlay series. For Okreek part of NtB, see Okreek series.	Severe: less than 40 inches deep over siltstone; moderately slow permeability.	Severe: less than 40 inches deep over siltstone.	Moderate: less than 40 inches deep over rippable siltstone.	Moderate: moderate shrink-swell potential; less than 40 inches deep over rippable siltstone.	Moderate: silty clay loam and clay loam texture; less than 40 inches deep over rippable siltstone.	Severe: 20 to 40 inches deep over rippable siltstone; AASHO group index greater than 8.
Okreek. Mapped only with Norrest soils.	Severe: slow permeability; less than 40 inches deep over siltstone.	Severe: less than 40 inches deep over siltstone.	Severe: clay texture.	Severe: high shrink-swell potential.	Severe: poor workability; clay texture.	Severe: high shrink-swell potential; poor stability and compaction characteristics.

See footnotes at end of table.

interpretations—Continued

Suitability as a source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
Fair: ML material; AASHO group index of 5 to 8.	Unsuitable: no sand or gravel.	Good, but low fertility.	Moderate permeability; some seepage likely in most areas.	Poor stability and compaction characteristics; moderate permeability if compacted; poor resistance to piping.	Moderate permeability.	High available water capacity; moderate water intake rate; deep rooting zone.	[3].
Poor: high shrink-swell potential.	Unsuitable: no sand or gravel.	Poor: 4 inch surface layer, claypan subsoil below.	Very slow permeability; low seepage.	Fair to poor stability and compaction characteristics; high compressibility.	Very slow permeability; claypan subsoil.	Claypan subsoil; high in sodium.	Very slow permeability; claypan subsoil.
Good	Fair to poor: some areas more than 15 percent fines.	Poor: gravelly material.	Rapid permeability in substratum.	Good stability; fair to good compaction characteristics; fair to poor resistance to piping.	Rapid permeability.	Low available water capacity; less than 20 inches deep over sand and gravel; many slopes not suited.	Shallow to sand and gravel.
Poor: AASHO group index greater than 8.	Unsuitable: no sand or gravel.	Good to 6 inches. Fair below: silty clay loam and clay loam texture.	Seepage potential in places; siltstone at a depth of 20 to 40 inches.	Fair to good stability and compaction characteristics; potential piping; medium to high compressibility.	Siltstone at moderate depth.	Low to medium available water capacity; slow water intake rate; many slopes unsuitable.	Moderately slow permeability; siltstone at a depth of 20 to 40 inches.
Poor: high shrink-swell potential.	Unsuitable: no sand or gravel.	Poor: clay texture.	Possible seepage in bedrock.	Poor stability and compaction characteristics; high volume change.	Slow permeability; siltstone at moderate depth.	Low to very low available water capacity; very slow water intake rate.	Slow permeability; siltstone at a depth of 20 to 40 inches.

TABLE 5.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary land fill [1]	Local roads and streets
*Opal: OcC, OgC, OlB, OlC, OmB, OpB, OtB, OtD, OwC. For Caputa part of OlB and OlC, see Caputa series. For Mosher part of OmB, see Mosher series. For Promise part of OpB, see Promise series. For Tuthill part of OtB and OtD, see Tuthill series. For Woodly part of OwC, see Woodly series.	Severe: very slow permeability; less than 40 inches deep over shale.	Severe: shale at a depth of less than 40 inches.	Severe: clay texture.	Severe: high shrink-swell potential.	Severe: clay texture.	Severe: high shrink-swell potential.
Orella: Ox. For Badland part of Ox, see Badland.	Severe: very slow permeability; less than 20 inches deep over shale.	Severe: less than 20 inches deep over shale.	Severe: clay texture; shallow over shale.	Severe: high shrink-swell potential; shale at a depth of 10 to 20 inches.	Severe: clay texture.	Severe: high shrink-swell potential.
*Promise: PcA, PcB, Pd, PgA, PgB, PmA, Ps. For Opal part of PgA and PgB, see Opal series. For Mosher part of PmA, see Mosher series. No interpretations for Slickspots part of Ps; material too variable.	Severe: slow to very slow permeability.	Slight if slope is 0 to 2 percent, moderate if 2 to 5 percent.	Severe: clay texture.	Severe: high shrink-swell potential.	Severe: clay texture.	Severe: high shrink-swell potential.
*Ree: ReB, RkA, RkB. For Keya part of RkA and RkB, see Keya series.	Moderate: moderate permeability.[2]	Moderate: moderate permeability; may be gravel below a depth of 40 inches.	Slight.	Moderate: moderate shrink-swell potential, CL material.	Moderate: clay loam texture.	Severe: AASHO group index greater than 8.
Reliance. Mapped only with Millboro soils.	Severe: moderately slow permeability.	Moderate if slope is 2 to 6 percent, severe if 6 to 9 percent.	Severe: clay texture.	Severe: high shrink-swell potential.	Moderate to severe: clay texture.	Severe: high shrink-swell potential.
*Samsil: SaE, SlD, SlE, SmE, SnE, Ss. For Lakoma part of SlD and SlE, see Lakoma series. For Manter part of SmE, see Manter series. For Schamber part of SnE, see Schamber series. No interpretations for Shale outcrop part of Ss; material too variable.	Severe: slow permeability; less than 20 inches deep over shale; steep slope.	Severe: less than 20 inches deep over shale; steep slope.	Severe: clay texture; steep slope.	Severe: slope; shallow over shale; high shrink-swell potential.	Severe: clay texture.	Severe: slope; high shrink-swell potential.

See footnotes at end of table.

interpretations—Continued

Suitability as a source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
Poor: high shrink-swell potential.	Unsuitable: no sand or gravel.	Poor: clay texture.	Shale at a depth of 20 to 40 inches; very slow permeability; possible seepage in shale fractures.	High volume change; fair to poor stability and compaction characteristics; high compressibility.	Very slow permeability; shale at moderate depth.	Low to very low available water capacity; very slow water intake rate; shale at moderate depths; many slopes unsuitable.	Shale at a depth of 20 to 40 inches; very slow permeability.
Poor: high shrink-swell potential.	Unsuitable: no sand or gravel.	Poor: clay texture.	Shale at a depth of 10 to 20 inches; very slow permeability.	Fair to poor stability and compaction characteristics; high volume change.	Shallow over shale; very slow permeability.	Shallow over shale.	Shallow over shale; very slow permeability.
Poor: high shrink-swell potential.	Unsuitable: no sand or gravel.	Poor: clay texture.	Slow to very slow permeability; low seepage.	High volume change; fair to poor stability and compaction characteristics; high compressibility.	Slow to very slow permeability.	Low to medium available water capacity; very slow water intake rate.	Slow to very slow permeability.
Poor: AASHO group index greater than 8; CL material.	Possible source below a depth of 4 feet in some areas.	Good in top 7 inches. Fair below: clay loam texture.	Moderate permeability; possible seepage in some areas below a depth of 5 feet.	Fair to good stability and compaction characteristics; medium to high compressibility.	Moderate permeability; sand and gravel below a depth of 4 feet in some areas.	High available water capacity; moderately slow water intake rate.	Moderate permeability.
Poor: high shrink-swell potential.	Unsuitable: no sand or gravel.	Fair in top 5 inches: silty clay loam texture. Poor below: silty clay texture.	Moderately slow permeability; low seepage.	Fair to poor stability and compaction characteristics; high compressibility.	Moderately slow permeability.	Medium to high available water capacity; slow water intake rate.	Moderately slow permeability; long, smooth slopes.
Poor: high shrink-swell potential.	Unsuitable: no sand or gravel.	Poor: clay texture.	Shale at a depth of 10 to 20 inches; possible seepage in shale fractures.	Poor stability and compaction characteristics; limited material.	Shallow over shale; slow permeability.	Shallow over shale; slow permeability; steep slope.	Shallow over shale; slope ranges up to 40 percent.

TABLE 5.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary land fill [1]	Local roads and streets
Sandy land: St. No interpretations; material too variable.						
Savo: SuA, SuB, SuC-----	Severe: moderately slow permeability.	Severe: sand and gravel commonly between a depth of 40 and 60 inches.	Slight, but possible sloughing in sand and gravel substratum.	Moderate to severe: moderate to high shrink-swell potential.	Moderate: silty clay loam texture.	Severe: plasticity index greater than 15; moderate to high shrink-swell potential.
*Schamber: SvE, SwE----- For Murdo part of SvE, see Murdo series. For Samsil part of SwE, see Samsil series.	Severe: steep slopes. Moderate if slope is less than 15 percent.[2]	Severe: rapid permeability.	Severe: very gravelly material.	Moderate if slope is 9 to 15 percent, severe if greater than 15 percent.	Severe: less than 10 inches deep over sand and gravel; some slopes are greater than 25 percent; rapid permeability.	Moderate if slope is 9 to 15 percent, severe if greater than 15 percent.
Stirk: Sy-----	Severe: subject to flooding; slow to very slow permeability.	Severe: subject to flooding.	Severe: clay texture; subject to flooding.	Severe: high shrink-swell potential; subject to flooding.	Severe: clay texture; subject to flooding.	Severe: high shrink-swell potential; subject to flooding.
*Tuthill: ThB, ToC, TuB, TwA, TwB. For Opal part of ToC, see Opal series. For Whitelake part of TuB, see Whitelake series. For Woodly part of TwA and TwB, see Woodly series.	Slight [2]-----	Severe: rapid permeability in substratum.	Slight-----	Moderate: moderate shrink-swell potential.	Severe: rapid permeability in substratum.	Moderate: moderate shrink-swell potential.
Valentine: VaE-----	Moderate if slope is 9 to 15 percent, severe if greater than 15 percent.[2]	Severe: rapid permeability.	Severe: sloughing; sandy texture.	Moderate if slope is 9 to 15 percent, severe if greater than 15 percent.	Severe: rapid permeability; poor cover material.	Moderate if slope is 9 to 15 percent, severe if greater than 15 percent.
*Wanblee: Wa, WbB----- For Whitelake part of Wa, see Whitelake series. For Wortman part of WbB, see Wortman series.	Severe: slow permeability; less than 40 inches deep over siltstone.	Severe: siltstone at a depth of 20 to 40 inches.	Severe: claypan subsoil; less than 50 inches deep over rippable siltstone.	Severe: high shrink-swell potential.	Moderate: 20 to 40 inches deep over rippable siltstone.	Severe: high shrink-swell potential; siltstone at a depth of 20 to 40 inches.

See footnotes at end of table.

interpretations—Continued

Suitability as a source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
Poor: plastic; moderate to high shrink-swell potential.	Possible source below a depth of 5 feet in some areas.	Fair: mostly silty clay loam texture.	Moderately slow permeability; sand and gravel below a depth of 40 inches in some areas.	Fair to poor stability and compaction characteristics; medium to high compressibility.	Moderately slow permeability; sand and gravel below a depth of 4 feet in some areas.	Medium to high available water capacity; moderately slow to slow water intake rate.	Moderately slow permeability.
Good if slope is less than 15 percent, fair if 15 to 25 percent, severe if greater than 25 percent.	Poor to fair: 5 to 30 percent fines.	Poor: gravelly.	Rapid permeability; high seepage.	Good stability; fair to good compaction characteristics; moderate permeability if compacted; fair to poor resistance to piping.	Rapid permeability.	Very shallow over gravel; slopes.	Very shallow over sand and gravel; short slopes of 9 to 40 percent.
Poor: highly plastic; high shrink-swell potential.	Unsuitable: no sand or gravel.	Poor: clay texture.	Slow to very slow permeability; low seepage.	High volume change; fair to poor stability and compaction characteristics; high shrink-swell potential.	Slow to very slow permeability; subject to flooding.	Low to medium available water capacity; very slow water intake rate; subject to flooding.	(3).
Fair in upper 2 feet: AASHO group index of 5 to 8. Good below.	Poor: more than 15 percent fines in sand.	Good in top 8 inches. Fair to a depth of 24 inches: sandy clay loam texture.	Rapid permeability in substratum.	Fair to good stability and compaction characteristics; poor resistance to piping.	Rapid permeability in substratum.	Medium available water capacity; moderate water intake rate.	Rapid permeability in substratum.
Good if slope is less than 15 percent, fair if greater than 15 percent.	Fair to poor for fine sand; no gravel.	Poor: fine sand texture.	Rapid permeability; high seepage.	Good to poor stability; fair to poor compaction characteristics; fair to poor resistance to piping.	Rapid permeability; rolling to steep slopes.	Slope; high susceptibility to soil blowing.	Rapid permeability; high susceptibility to soil blowing.
Poor: high shrink-swell potential.	Unsuitable: no sand or gravel.	Poor: claypan subsoil below thin surface layer.	Slow permeability; possible seepage in substratum.	Fair stability and compaction characteristics; medium to high compressibility; high shrink-swell potential.	Slow permeability; siltstone at moderate depth.	Claypan subsoil; high sodium content.	Claypan subsoil; 20 to 40 inches deep over siltstone.

TABLE 5.—*Engineering*

Soil series and map symbols	Degree and kind of limitation for					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings with basements	Sanitary land fill [1]	Local roads and streets
Whitelake Mapped only with Tuthill and Wanblee soils.	Severe: moderately slow to slow permeability.	Severe: temporary water table.	Moderate: moderately well drained; temporary water table.	Moderate: moderately well drained; moderate shrink-swell potential; temporary water table.	Severe: temporary water table.	Moderate: moderate shrink-swell potential.
*Woodly: Wd, WoB For Opal part of WoB see Opal series.	Slight [2]	Severe: moderately rapid permeability in substratum; subject to flooding in some areas.	Severe: subject to run-in water.	Slight to moderate: low to moderate shrink-swell potential; SC or CL material.	Severe: moderately rapid permeability in substratum.	Moderate: low to moderate shrink-swell potential; SC or CL material.
*Wortman: Ww For Wanblee part of Ww, see Wanblee soils.	Severe: very slow permeability; less than 40 inches deep over siltstone.	Severe: siltstone at a depth of 20 to 40 inches.	Severe: claypan subsoil.	Severe: high shrink-swell potential.	Moderate: silty clay loam subsoil; 20 to 40 inches deep over rippable siltstone.	Severe: high shrink-swell potential.

[1] Onsite study is needed of the underlying strata, the water table, and the hazards of aquifer pollution and drainage into ground water in landfill deeper than 5 or 6 feet.

interpretations—Continued

Suitability as a source of—			Soil features affecting—				
Road fill	Sand and gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions
Fair: moderate shrink-swell potential.	Unsuitable: sand and gravel substratum in places; temporary or permanent water table in the substratum.	Good to a depth of 16 inches. Poor below: claypan subsoil.	Possible seepage in substratum in some areas; temporary water table in substratum.	Fair to good stability and compaction characteristics; poor resistance to piping.	Moderately slow to slow permeability in subsoil; temporary water table.	Moderately slow to slow permeability; claypan subsoil; possible salt accumulation.	Moderately slow to slow permeability; temporary water table.
Fair: low to moderate shrink-swell potential; SC or CL material.	Poor: 20 to 30 percent fines.	Good	High seepage; moderately rapid permeability in substratum.	Fair to good stability and compaction characteristics; poor resistance to piping.	Moderately rapid permeability in substratum.	Medium to high available water capacity; moderate water intake rate.	Moderately rapid permeability in substratum.
Poor: high shrink-swell potential.	Unsuitable: no sand or gravel.	Poor: 5 inch surface layer over claypan subsoil.	Possible seepage in siltstone.	Fair to poor stability and compaction characteristics; highly compressible.	Very slow permeability; siltstone at moderate depths.	Claypan subsoil; high in sodium.	Very slow permeability; siltstone at a depth of 20 to 40 inches.

[2] Possible source of pollution for domestic water supplies.
[3] Practice generally not applicable.

TABLE 6.—*Engineering test data*

[Tests made by the South Dakota Department of Highways. Dashed lines indicate that soils were not tested for that property]

Soil series	Horizon	Number of samples tested	Mechanical analysis [1]						Liquid limit [2]		Plasticity index [3]		Classification			Estimated CBR [7]
			Percentage less than 3 inches passing sieve—													
			No. 10 (2.0 mm.)		No. 40 (0.42 mm.)		No. 200 (0.074 mm.)									
			Range	Average	Range	Average	Range	Average	Range	Average	Range	Average	AASHO [4] (Old index)	AASHO [5] (New index)	Unified [6]	
Altvan.	A	11	75–100	93	66–100	87	37–93	65	22–47	34	2–22	11	A–6(7)	A–6(6)	ML–CL	7
	B	28	76–100	93	52–100	84	32–93	63	25–47	36	7–29	18	A–6(9)	A–6(9)	CL	6
	IIC	38	2–87	45	0–76	35	0–60	22	9–53	31	0–31	14	A–2–6(0)	A–2–6(0)	GC	--------
Anselmo.	A	7	95–100	99	84–100	93	23–48	35	17–28	23	0–14	5	A–2–4(0)	A–2–4(0)	SM–SC	--------
	B	15	97–100	100	86–100	95	20–45	33	18–26	22	0–13	5	A–2–4(0)	A–2–4(0)	SM–SC	--------
	C	16	97–100	100	80–100	93	13–44	28	5–33	19	0–13	5	A–2–4(0)	A–2–4(0)	SM–SC	--------
Bankard.	C	9	84–100	95	51–100	82	8–31	20	0–29	9	0–9	2	A–2–4(0)	A–2–4(0)	SM	--------
Buffington.	B	9	99–100	100	97–100	99	72–100	87	38–67	52	17–40	28	A–7–6(18)	A–7–6(27)	CH	3
	C	17	90–100	98	88–100	96	70–100	86	35–62	49	17–39	28	A–7–6(17)	A–7–6(25)	CL	3
Caputa.	A	26	87–100	97	82–100	93	62–93	78	34–55	44	15–31	22	A–7–6(14)	A–7–6(18)	CL	4
	B	166	85–100	97	79–100	93	61–100	81	37–61	49	18–40	29	A–7–6(17)	A–7–6(24)	CL	3
	C	188	77–100	95	65–100	90	43–100	73	31–63	47	14–41	27	A–7–6(16)	A–7–6(19)	CL	4
	C2	49	29–100	75	14–100	68	0–100	59	19–88	53	4–60	32	A–7–6(14)	A–7–6(16)	CH	3
Conata.	C	16	95–100	99	89–100	97	75–100	89	46–88	67	24–58	41	A–7–6(20)	A–7–6(41)	CH	2
	C [8]	11	99–100	100	97–100	99	83–100	92	25–82	53	10–54	32	A–7–6(19)	A–7–6(32)	CH	3
Glenberg.	C	16	83–100	97	75–100	93	30–88	59	18–34	26	0–13	6	A–4(5)	A–4(2)	ML–CL	11
Haverson.	A	12	99–100	100	91–100	97	63–100	85	31–54	42	10–28	19	A–7–6(12)	A–7–6(17)	CL	5
	C	44	82–100	98	78–100	96	49–100	78	22–44	33	2–23	12	A–6(9)	A–6(9)	CL	7
Hisle.	B	6	98–100	100	95–100	98	82–100	92	45–83	64	22–58	40	A–7–6(20)	A–7–6(41)	CH	2
	C	7	91–100	98	87–100	97	81–100	93	29–77	53	12–52	32	A–7–6(19)	A–7–6(32)	CH	3
	C [8]	3	99–100	100	97–100	98	87–100	94	63–88	75	36–60	48	A–7–6(20)	A–7–6(52)	CH	1
Imlay.	C	29	90–100	99	78–100	95	52–100	79	30–59	45	12–36	24	A–7–6(15)	A–7–6(19)	CL	4
	C [8]	6	98–100	100	96–100	99	58–97	78	26–54	40	12–36	23	A–6(14)	A–6(17)	CL	5
Kadoka.	A	12	99–100	100	95–100	98	78–100	89	34–52	43	5–26	15	A–7–6(11)	A–7–6(16)	ML–CL	4
	B	21	99–100	100	97–100	99	73–99	86	35–47	41	12–27	19	A–7–6(12)	A–7–6(17)	CL	5
	C	45	99–100	100	93–100	98	61–100	82	31–53	42	6–31	18	A–7–6(12)	A–7–6(16)	CL	5
	C [8]	4	--------	100	90–100	97	69–100	87	36–59	48	17–31	23	A–7–6(15)	A–7–6(22)	CL	4
Keota.	A	7	--------	100	92–100	98	75–100	89	31–48	40	14–26	20	A–6(12)	A–6(18)	CL	5
	C	9	--------	100	99–100	100	85–99	92	32–53	42	3–36	19	A–7–6(12)	A–7–6(19)	CL	5
Kolls.	B	7	--------	100	95–100	98	91–100	96	42–100	71	21–75	48	A–7–6(20)	A–7–6(33)	CH	1
	C	21	--------	100	95–100	99	87–100	96	47–115	81	24–86	54	A–7–6(20)	A–7–6(61)	CH	1

Kyle.	A	23	99–100	100	95–100	98	77–100	90	36–68	52	16–42	28	A–7–6(18)	A–7–6(28)	CH	3
	B	192	91–100	99	88–100	97	80–100	92	51–80	66	28–54	41	A–7–6(20)	A–7–6(45)	CH	2
	C	221	91–100	99	89–100	98	80–100	93	49–87	68	27–58	42	A–7–6(20)	A–7–6(45)	CH	1
	C [8]	15	94–100	99	91–100	97	83–100	93	48–101	75	22–72	47	A–7–6(20)	A–7–6(51)	CH	1
Lakoma.	A	12	98–100	100	90–100	97	69–100	86	38–89	63	11–57	33	A–7–6(20)	A–7–6(33)	MH–CH	2
	B	23	99–100	100	95–100	98	86–100	94	46–85	65	21–54	37	A–7–6(20)	A–7–6(41)	CH	2
	C	45	95–100	99	93–100	98	83–100	94	47–86	66	21–55	38	A–7–6(20)	A–7–6(42)	CH	2
	C [8]	101	99–100	100	93–100	99	85–100	95	51–101	76	28–67	47	A–7–6(20)	A–7–6(53)	CH	1
Larvie.	B	7	99–100	100	97–100	99	89–100	95	47–91	69	27–59	42	A–7–6(20)	A–7–6(47)	CH	1
	C [8]	22	93–100	99	73–100	93	55–100	84	41–89	65	24–57	40	A–7–6(20)	A–7–6(37)	CH	1
Lowry.	A	6	82–100	96	74–100	94	63–100	89	31–43	37	5–16	10	A–4(8)	A–4(10)	ML–CL	6
	B	29	99–100	100	93–100	98	63–100	87	26–39	33	5–14	9	A–4(8)	A–4(8)	ML–CL	7
	C	31	91–100	99	73–100	95	51–100	85	20–48	34	3–23	12	A–6(9)	A–6(10)	CL	7
Manter.	B	7	98–100	99	64–100	84	12–60	36	17–31	24	0–16	6	A–4(0)	A–4(0)	SM–SC	12
	C	14	86–100	97	44–91	67	8–28	18	4–27	16	0–7	2	A–2–4(0)	A–2–4(0)	SM	--------
Millboro.	A	34	99–100	100	91–100	97	76–100	89	39–61	50	13–34	23	A–7–6(16)	A–7–6(24)	ML–CL	3
	B	94	99–100	100	93–100	98	82–100	92	44–75	59	18–52	34	A–7–6(20)	A–7–6(36)	CH	2
	C	132	99–100	100	92–100	97	80–100	92	44–77	60	21–50	35	A–7–6(20)	A–7–6(36)	CH	2
	C [8]	15	98–100	100	97–100	99	91–99	95	45–98	72	19–71	45	A–7–6(20)	A–7–6(50)	CH	1
Minatare.	A	4	--------	100	95–100	99	55–100	80	23–38	31	1–13	7	A–4(8)	A–4(5)	ML–CL	8
	B	12	99–100	100	94–100	99	74–100	89	38–60	49	14–37	25	A–7–6(16)	A–7–6(25)	CL	3
	C	6	99–100	100	85–100	96	51–100	82	27–57	42	4–35	19	A–7–6(12)	A–7–6(16)	CL	5
Mosher.	A	5	--------	100	98–100	99	66–100	83	27–58	42	3–34	18	A–7–6(12)	A–7–6(16)	CL	5
	B	18	99–100	100	98–100	99	70–100	87	30–67	48	9–45	27	A–7–6(16)	A–7–6(25)	CL	4
	C	8	--------	100	99–100	100	75–100	89	22–59	41	1–40	20	A–7–6(13)	A–7–6(19)	CL	5
Murdo.	C	17	38–100	74	20–88	54	6–59	32	15–53	34	1–30	15	A–2–6(1)	A–2–6(1)	SC	--------
	IIC2	8	35–100	76	6–100	62	0–96	41	0–89	42	0–59	21	A–7–6(4)	A–7–6(4)	SC	5
Norrest.	A	3	--------	100	--------	100	83–99	91	32–62	47	10–39	24	A–7–6(15)	A–7–6(24)	CL	4
	B	12	92–100	99	89–100	97	65–100	84	30–70	50	12–45	28	A–7–6(17)	A–7–6(25)	CL	3
	C	5	94–100	98	83–100	93	47–98	73	29–79	51	16–48	31	A–7–6(18)	A–7–6(22)	CH	3
	C [8]	4	--------	100	97–100	99	87–99	93	37–97	67	19–63	41	A–7–6(20)	A–7–6(44)	CH	2
Opal.	A	51	99–100	100	94–100	98	84–100	93	45–79	62	18–46	32	A–7–5(20)	A–7–5(35)	MH–CH	2
	B	87	96–100	99	91–100	98	83–100	94	53–88	71	29–58	43	A–7–6(20)	A–7–6(47)	CH	1
	C	131	99–100	100	96–100	99	89–100	96	55–93	74	29–61	44	A–7–6(20)	A–7–6(51)	CH	1
	C [8]	263	97–100	100	93–100	99	86–100	96	56–98	77	30–65	47	A–7–6(20)	A–7–6(54)	CH	1
Orella.	C	26	97–100	100	94–100	98	85–100	94	44–114	79	25–78	51	A–7–6(20)	A–7–6(56)	CH	1
	C [8]	16	99–100	100	81–100	96	65–100	89	48–109	78	29–78	53	A–7–6(20)	A–7–6(53)	CH	1
Promise.	A	37	96–100	99	93–100	98	84–100	93	45–71	58	18–39	28	A–7–5(19)	A–7–5(31)	MH–CH	2
	B	110	97–100	99	92–100	98	85–100	95	49–87	68	26–56	41	A–7–6(20)	A–7–6(45)	CH	1
	C	237	99–100	100	93–100	98	86–100	95	52–85	69	28–54	40	A–7–6(20)	A–7–6(45)	CH	1
	C [8]	46	98–100	100	96–100	99	91–100	96	56–103	80	32–66	48	A–7–5(20)	A–7–5(56)	CH	1
Ree.	A	5	97–100	99	82–100	92	71–95	83	30–46	38	11–15	12	A–6(9)	A–6(11)	NL–CL	6
	B	15	92–100	98	79–100	90	51–92	71	31–45	38	13–25	18	A–6(11)	A–6(12)	CL	6
	C	15	86–100	95	72–100	89	47–88	68	23–49	36	9–29	18	A–6(10)	A–6(11)	CL	6

See footnotes at end of table.

TABLE 6.—*Engineering test data*—Continued

Soil series	Horizon	Number of samples tested	Mechanical analysis [1]						Liquid limit [2]		Plasticity index [3]		Classification			Estimated CBR [7]
			Percentage less than 3 inches passing sieve—													
			No. 10 (2.0 mm.)		No. 40 (0.42 mm.)		No. 200 (0.074 mm.)									
			Range	Average	Range	Average	Range	Average	Range	Average	Range	Average	AASHO [4] (Old index)	AASHO [5] (New index)	Unified [6]	
Reliance.	A	12	98–100	99	87–100	96	64–100	85	34–48	41	11–22	16	A–7–6(11)	A–7–6(15)	ML–CL	5
	B	31	98–100	100	92–100	98	68–100	88	36–59	48	16–35	25	A–7–6(16)	A–7–6(24)	CL	4
	C	30	96–100	99	91–100	97	66–100	87	35–59	47	17–35	26	A–7–6(16)	A–7–6(24)	CL	4
	C2	23	68–100	94	53–100	89	21–100	74	16–118	67	4–78	40	A–7–6(20)	A–7–6(31)	CH	2
Samsil.	A	15	84–100	97	80–100	95	69–100	88	36–75	55	14–42	28	A–7–6(18)	A–7–6(28)	MH–CH	3
	C	43	97–100	100	91–100	97	78–100	91	47–85	66	26–58	41	A–7–6(20)	A–7–6(43)	CH	2
	C [8]	203	97–100	100	93–100	98	84–100	95	45–116	80	21–84	52	A–7–6(20)	A–7–6(58)	CH	1
Schamber.	C	45	30–100	69	10–100	55	0–59	29	7–54	30	0–29	12	A–2–6(0)	A–2–6(0)	SC	--------
	C2	20	9–100	63	0–100	55	0–74	32	13–51	32	0–30	12	A–2–6(0)	A–2–6(0)	SC	--------
Tuthill.	A	13	87–100	98	70–100	89	24–80	52	16–42	29	1–20	10	A–4(3)	A–4(3)	CL	9
	B	43	94–100	99	72–100	90	25–83	54	15–50	33	0–29	14	A–6(6)	A–6(5)	CL	7
	C	48	79–100	96	57–100	79	0–71	35	0–48	24	0–27	7	A–2–4(0)	A–2–4(0)	SC	--------
Valentine.	C	27	--------	100	82–100	93	0–17	8	0–14	3	0–1	0	A–3(0)	A–3(1)	SM	--------
Wanblee.	B	5	--------	100	92–100	97	61–100	83	29–70	50	15–44	29	A–7–6(18)	A–7–6(25)	CL	3
	C	16	99–100	100	94–100	98	68–100	86	35–76	56	18–50	34	A–7–6(19)	A–7–6(32)	CH	3
	C [8]	5	--------	100	97–100	99	79–100	90	32–53	43	15–31	23	A–7–6(14)	A–7–6(22)	CL	4
Wortman.	B	13	99–100	100	93–100	98	76–100	89	36–78	57	18–50	34	A–7–6(19)	A–7–6(33)	CH	3
	C	32	98–100	100	90–100	97	59–100	85	35–80	57	17–53	35	A–7–66(9)	A–7–6(32)	CH	3

[1] Mechanical analyses according to the AASHO Designation T 88. Results by this procedure may differ somewhat from the results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by hydrometer method, and the various grain-size fractions are calculated on the basis of all material up to and including that 3 inches in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from the calculations of grain-size fractions. The mechanical analyses data used in this table are not intended for naming textural classes of soil.

[2] Based on AASHO Designation T 89–60.

[3] Based on AASHO Designation T 90–61.

[4] Based on AASHO Designation M 145–49.

[5] Based on AASHO Designation M 145–66I.

[6] SCS and BPR have agreed to consider that all soils having plasticity indexes within two points of A-line are to be given a borderline classification. Examples of borderline classifications obtained by this use are ML–CL and SM–SC.

[7] Estimated values based on relationships between California Bearing Ratio and liquid limit.

[8] Bedrock.

Engineering classification

The two systems most commonly used in classifying samples of soil horizons for engineering are the AASHO system, adopted by the American Association of State Highway Officials, and the Unified system, used by SCS engineers, the Department of Defense, and others.

The AASHO system (*1*) is used to classify soils according to those properties that affect use in highway construction. In this system a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade. At the other extreme, in group A–7 are clay soils that have low strength when wet. The best soils for subgrade are, therefore, classified as A–1, the next best A–2, and so on to class A–7, which are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. If soil material is near a classification boundary, it is given a symbol showing both classes; for example, A–2 or A–4. Within each group the relative engineering value of a soil material is indicated by a group index number. Group indexes range from 0, for the best material, to 20, for the poorest.

In the Unified system (*7*) soils are classified according to particle-size distribution, plasticity, liquid limit, and organic-matter content. Soils are grouped into 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. GP and GW are clean gravel, and GM and GC are gravel that includes, respectively, an appreciable amount of nonplastic and plastic fines. SP and SW are clean sands. SM and SC are sands that include fines of silt and clay. ML and CL are silts and clays that have a low liquid limit, and MH and CH are silts and clays that have a high liquid limit. Soils on the borderline between two classes are designated by symbols for both classes; for example, ML–CL.

Soil scientists use the USDA textural classification. In this, the texture of the soil is determined according to the proportion of soil particles smaller than 2 millimeters in diameter, that is, the proportion of sand, silt, and clay. Textural modifiers, such as gravelly, stony, shaly, and cobbly, are used as needed.

Table 6 shows the AASHO and Unified classification of specified soils in the county as determined by laboratory tests. Table 4 shows the estimated classification of all the soils in the county according to all three systems of classification.

Estimates of soil properties

Table 4 provides estimates of soil properties important in engineering. These estimates are based on field classification and descriptions, physical and chemical tests of selected representative samples, test data from comparable soils in adjacent areas, and detailed experience in working with the individual soil in the survey area. Some of the terms for which data are shown are explained in the following paragraphs.

Permeability, as used in table 4, relates only to movement of water downward through undisturbed and uncompacted soil in a saturated condition; it does not include lateral seepage. The estimates are based on soil characteristics that influence porosity of the soil. Plowpans, surface crusts, and other properties that result from use of these soils are not considered.

Available water capacity is the capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Reaction is the degree of acidity or alkalinity of a soil, expressed as a pH value. The pH test is made on a water solution of the soil. The pH value and relative terms used to describe soil reaction are explained in the glossary.

Salinity of the soil is based on the electrical conductivity of the saturated soil extract, as expressed in millimhos per centimeter at 25° C. The salinity rating and salinity in millimhos per centimeter are listed below:

Salinity rating	*Salinity in millimhos per centimeter*
None	Less than 2.0.
Low	2.0 to 4.0.
Moderate	4.0 to 8.0.
High	8.0 to 16.0.
Very high	More than 16.0.

Salinity affects the suitability of a soil for crop production, its stability when used as construction material, and its corrosiveness to other materials.

Shrink-swell potential is an indication of the volume change in the soil material to be expected with changes in moisture content. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A high shrink-swell potential indicates a hazard to the maintenance of structures constructed in, on, or with such material.

Corrosivity, as used here, indicates the potential danger to uncoated steel or concrete structures from chemical action that dissolves or weakens the structural material. Structural material may corrode when buried in soil. A given material corrodes more rapidly in some kinds of soil than in others. Extensive installations that intersect soil boundaries or soil horizons are more likely to be damaged by corrosion than are installations entirely in one kind of soil or one soil horizon.

Engineering interpretations

Table 5 contains selected information useful to engineers and others who plan to use soil material in the construction of highways, farm facilities, buildings, and sewage disposal systems. Detrimental or undesirable features are emphasized, but important desirable features are also listed. The ratings and other interpretations in this table are based on the estimated engineering properties of the soil given in table 4; on available test data, including those in table 6; and on field experience. The information applies only to the soil depth indicated in table 4, but is reasonably reliable to a depth of about 5 or 6 feet.

Septic tank absorption fields are affected mainly by permeability, height of the water table, susceptibility to flooding, and percent slope.

Sewage lagoons are influenced chiefly by permeability, height of the water table, and slope.

Shallow excavations, less than 6 feet deep, refer to those made for basements, ditches, graves, underground cables, pipelines, and sewers.

Ratings for dwellings with basements are based chiefly on soil characteristics that affect foundations, but slope, susceptibility to flooding, seasonal wetness, depth to bedrock, and other conditions are also considered.

Sanitary landfill is an engineering method for disposing of solid wastes on or in the soil by spreading the waste in thin layers, compacting it to the smallest practical volume, and covering it with soil each day in a manner that provides maximum protection of the environment.

Local roads and streets are roadways that are expected to carry all automobile traffic but fast-moving, heavy trucks. Ratings pertain to the construction and maintenance of improved roads and streets that have some kind of all-weather surfacing, commonly asphalt or concrete.

The suitability of the soil as a source of road fill, sand and gravel, and topsoil is expressed as good, fair, or poor.

Road fill is the material used as an embankment to support the subbase and base course or surface course. The ratings indicate performance of soil material moved from borrow areas for these purposes.

Ratings for sand and gravel are based on the probability that delineated areas of the soil contain deposits of sand or sand and gravel. They provide guidance in where to locate deposits, but do not indicate size of the deposit.

Topsoil is soil material that is spread over barren surfaces, lawns, and gardens to improve soil conditions for establishing or maintaining adapted vegetation.

Pond reservoir areas are affected mainly by loss of water through seepage.

The factors considered for embankments, dikes, and levees are the features and qualities of disturbed soils that affect their suitability for constructing earthfill. The features of both the subsoil and the substratum are evaluated if they have significant thickness for use as borrow material.

Drainage is influenced by those features and qualities of the soil that affect the installation and performance of surface and subsurface drainage systems.

Irrigation is influenced chiefly by soil features that limit water movement, for example, water intake rate, permeability, available water capacity, depth of the rooting zone, susceptibility to stream overflow, salinity, stoniness, slope, the hazard of wind and water erosion, and an impermeable soil layer.

Terraces and diversions are influenced by those features and qualities of the soil that affect stability of these structures or hinder layout and construction. The hazard of sedimentation in channels and the difficulty of establishing and maintaining cover on diversions are also important.

Engineering test data

Table 6 contains the results of engineering tests performed by the South Dakota Department of Highways on soils in Mellette County and surrounding counties. These soil samples were taken along proposed highway routes.

Samples were taken from the major horizons indicated, at depths that reflect distinct changes in color and texture. The samples, therefore, may include material from more than one major horizon of a given soil. Because of this difference in sampling, the range in properties in table 6 is not necessarily the same as the range shown in table 4.

Mechanical analysis shows the actual range of and the average of the percentage, by weight, of soil particles that pass through sieves of specified sizes. Sand and other coarser material, for example, do not pass the No. 200 sieve.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material passing the No. 40 sieve. As the moisture content of a clayey soil is increased from a dry state, the material changes from a solid to a plastic state. If the moisture content is increased further, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from solid to plastic. The liquid limit is the moisture content at which the material changes from plastic to liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Formation and Classification of the Soils

This section tells how the factors of soil formation have affected the soils in Mellette County. It also explains the current system of soil classification and classifies all the soil series represented in the county according to that system.

Factors of Soil Formation

Soil is produced by soil-forming processes that act on material deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and existed; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material, which has accumulated through the weathering of rocks, and slowly change it to soil material that has genetically related horizons. The parent material affects the kind of soil profile that is formed and, in some cases, determines it almost entirely. Relief conditions the effects of climate and plant and animal life on the parent material. Time is needed to change the parent material into a soil profile. Usually a long time is required for the formation of distinct horizons.

The soils of Mellette County formed from clayey shales of the Pierre Formation; shale, siltstone, and sandstone of Tertiary age; and unconsolidated material

relocated by wind and water. The relief in the county is hilly, rolling, undulating, nearly level, and depressional. The climate is semiarid to subhumid. The plant life is mainly grasses, and the animal life is of the plains variety. The time of soil formation in the county has ranged from some time during or following the glacial period to the present.

In the following paragraphs the factors of soil formation, as they apply to the soils in Mellette County, are described.

Parent material

All of Mellette County is underlain by Pierre Shale. This shale was formed by the very slow accumulation of clay and silt in an ancient sea that once covered the central United States. About 60 million years ago the area was pushed upward above sea level. Subsequently, erosion in Mellette County removed the uppermost beds deposited in the ancient sea and formed a hilly landscape. Hills of this landscape can still be seen buried in some Badland areas where bedrock of Tertiary age lies over and beside the hills formed from Pierre Shale.

The Tertiary-age bedrock consists of material that eroded from the Rocky Mountains or Black Hills and was carried by rivers into Mellette County, where it was deposited over the Pierre Shale. This material was partially reworked by wind and altered by the processes of soil formation. Each period of deposition buried an older soil and began another period of soil formation. Part of the variation in the present day soils that formed in Tertiary-age bedrock can be traced back to this ancient soil formation. The grayer beds of soils in the Badland are probably more nearly the color of the material when it was first deposited; the reddish-colored beds were caused by the soil formation millions of years ago.

The deposition of Tertiary-age material, which was compacted and cemented into rock, ended about a million or so years ago. Later, erosion removed these beds from the northern and eastern parts of Mellette County and uncovered the Pierre Shale once again. This erosion, which is going on even today, has not been continuous in the past. Rivers cut deep valleys, as the White River and Little White River are cutting today, and then meandered over a wide area and eroded the adjacent hills into a gently sloping landscape. The high, nearly level terraces or benches adjacent to the rivers were once the flood plain where the rivers meandered. These terraces are stream-deposited gravel that is overlain by loamy material. In some areas where nearly level terraces once stood, gravel-capped hills formed as smaller creeks eroded into the terraces. High terraces also occur along the small creeks. They formed at the same time as those adjacent to the rivers. Most of the high terraces formed by small creeks have been destroyed by erosion in the area near the large rivers, but in some places the terraces remain, particularly in the southern part of the county where the creeks have not yet eroded deep valleys and the adjacent slopes are more gentle. Low terraces, which are only a few feet higher than the channel, border the creeks and rivers today. Some of these low-lying terraces still are flooded, and additional material is gradually deposited on them.

During periods when the streams were not eroding deeper channels, the adjacent uplands were eroded down to gentle slopes. Thus, the undulating and rolling landscapes, on the divides between the major creeks, formed thousands of years ago when the rivers flowed at the elevation of the high terraces. Except in areas where soil blowing has been very severe, soils on these divides have had a longer period in which to form than those in hilly areas where the downcutting of streams has been more recent.

Soil blowing, which probably has occurred during at least the last few hundred thousand years, helped shape the hills and orient many small drainageways in a northwest-southeast direction. Such erosion apparently has been more rapid at some times than at others. During periods of severe blowing, sandy material was blown from the terraces and piled on the adjacent uplands. Because the prevailing wind is northwest-southeast, most areas of dune sand lie southeast of large, high terraces. Some of these dunes were stabilized by vegetation thousands of years ago, possibly when winds were lighter or precipitation was greater. In a few areas blowouts are still forming, and the soils are very young and show few or no horizons.

Probably, winds eroded sandy material from the high terraces when the climate was much colder and the eastern part of South Dakota was covered by large glaciers. Probably about this same time, some areas of Pierre Shale near Mosher and Wood and west of Oak Creek were also eroded by wind. Blowouts that were carved into the shale are now ponds in depressions. The shale fragments, sand, and silt mixed by the wind and then deposited became the loamy or silty clay loam parent material of the Reliance soils in this area.

Relief

The relief in Mellette County has been shaped by water erosion and soil blowing. Relief alters soil formation mainly in the way slopes occur on the landscape and affect runoff water. Runoff is rapid on steep slopes, and little water soaks into the parent material. In addition, erosion is severe if runoff is rapid, and soil material is removed nearly as fast as it forms.

Climate

The present climate of Mellette County is described in the section "General Nature of the County."

Plant and animal life

The soils of Mellette County formed under prairie vegetation. Although the kinds of grass and forbs may vary according to the kinds of soils, their effect on soil formation is uniform.

Animals mix the soil when they burrow. Except for isolated areas where prairie dogs have been active, burrowing animals have not been active in the county.

Time

The soils in Mellette County formed after the uppermost Tertiary-age beds were removed by erosion. This erosion apparently started during the glacial period and is continuing today. Thus, the oldest soils are at most a few tens of thousands of years old. Some soils on flood plains of the creeks and rivers are only a few years old.

Processes of Soil Formation

The five factors of soil formation interact to form a soil. Some characteristics are derived from the parent material. Others gradually develop with time. Soil horizons form in the parent material as organic matter accumulates from the decay of plants and animals. Most of this organic matter is in the surface layer, or A horizon, and gives it a dark color. The A horizon commonly contains less clay than the B horizon. Some of the clay in the parent material of the A horizon is washed downward by water and deposited in the B horizon. This movement of water through the soil leaches or washes out the more soluble salts in the parent material.

The very soluble salts are leached completely from the soil if it is well drained. In a few areas shown by symbols on the soil map, drainage is not adequate to remove the salts, and a saline soil forms. Many well drained and moderately well drained soils have slightly soluble sulfate and carbonate salts in the lower part of the B horizon and in the C horizon. In these soils the sulfate and carbonate have been partially or completely removed from the surface layer by plants and by water seepage that redeposits them in the drier lower layers. The B and C horizons that have accumulated carbonate, sulfates, or very soluble salts are shown, respectively, by the letters "ca," "cs," or "sa." The Bsa and Csa horizons frequently occur in claypan soils where leaching has been very slow. Sodium in these soluble salts causes poor structure in the claypan.

In a clayey soil, structure forms as the soil shrinks and swells. As a soil shrinks when dry, cracks develop, and as it swells when moist, the cracks close. The shrinking and swelling that increase as the clay content increases favor the formation of blocky structure. If the clay content is very large, parallelepipeds form, particularly in the subsoil where the organic matter content is low. Thus, parallelepipeds are abundant in the subsoil of young clay soils, for example, Stirk soils, but do not occur in the sandier soils, such as Tuthill soils.

Prisms form most rapidly in soils that have sufficient clay to cause shrinking and cracking when dry but not enough clay to cause swelling and the formation of parallelepipeds when wet. Caputa loam is an example. Both blocks and prisms are distinct in soils that have a moderate amount of clay, in Savo soils, for example. In younger soils, like Buffington silty clay loam, this structure has not yet had time to form.

Granular structure, such as that in the surface layer of Duroc soils, appears to have formed mainly in accumulations of organic matter, and to a lesser extent in clay.

Thus, parent material gradually changes to soil through the addition of organic matter by plants, the movement of material downward in the soil by water, and the drying and moistening processes. Each of these is affected by the climate, which is typically uniform in Mellette County. Relief alters the rate of soil formation by controlling the amount of runoff, and consequently the amount of erosion and the amount of water available for soil formation. Huggins and Duroc soils both formed in material weathered from siltstone, but the difference in slope caused significant differences in the two soils. The steeper, well-drained Huggins soils are not so deep as the shallower, moderately well drained Duroc soils, and they contain less organic matter than those soils. Relief also determines the hazard of erosion. For example, the steep, excessively drained Epping soils are more susceptible to erosion than the gently sloping, well-drained Huggins soils, and their horizons are less distinct.

Classification of the Soils

The purpose of soil classification is to help us remember the significant characteristics of soils, assemble our knowledge about the soils and their relationships to one another and to the whole environment, and develop principles relating to their behavior and their response to manipulation. First through classification and then through the use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The current system of soil classification (*3*, *6*) was adopted by the Cooperative Soil Survey in 1965. It is a comprehensive system, designed to accommodate all soils. In this system classes of soils are defined in terms of observable or measurable properties. The properties chosen are primarily those that result in the grouping of soils of similar genesis, or mode of origin. Genesis does not, however, appear in the definitions of the classes.

The current system of classification has six categories. Beginning with the most inclusive, the categories are the order, the suborder, the great group, the subgroup, the family, and the series. Table 7 shows the classification of the soils of Mellette County according to this system. Brief descriptions of the six categories follow.

ORDER.—Ten soil orders are recognized: Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate orders are those that tend to give broad climatic groupings of soils. Two exceptions to this generalization are the Entisols and the Histosols, both of which occur in many different climates. Four of the ten orders are represented in Mellette County: Entisols, Aridosols, Mollisols, and Inceptisols.

Entisols are light-colored soils that do not have natural genetic horizons or that have only very weakly expressed beginnings of such horizons. These soils do not have traits that reflect soil mixing caused by shrinking and swelling.

Aridisols are light-colored mineral soils that are high in bases and have well-expressed mineral genetic horizons.

Mollisols have formed under grass and have a thick, dark-colored surface horizon that contains colloids dominated by bivalent cations. The soil material in these soils has not been mixed by shrinking and swelling.

Inceptisols are light-colored mineral soils that are high in bases and have weakly expressed mineral genetic horizons.

SUBORDER.—Each order is divided into suborders, mainly on the basis of soil characteristics that result in grouping soils according to genetic similarity. The climatic range is narrower than that of the order. The

TABLE 7.—*Soil series classified according to the current system of classification*

Soil series	Family	Subgroup	Order
Altvan	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Aridic Argiustolls	Mollisols.
Anselmo	Coarse-loamy, mixed, mesic	Typic Haplustolls	Mollisols.
Bankard	Sandy, mixed, mesic	Ustic Torrifluvents	Entisols.
Blackpipe	Fine, mixed, mesic	Aridic Argiustolls	Mollisols.
Buffington	Fine, mixed, mesic	Torriorthentic Haplustolls	Mollisols.
Caputa	Fine, mixed, mesic	Aridic Argiustolls	Mollisols.
Cedar Butte	Fine, mixed, mesic	Ustollic Natrargids	Aridisols.
Conata	Clayey, montmorillonitic, mesic, shallow	Ustertic Camborthids	Aridisols.
Dunday	Sandy, mixed, mesic	Entic Haplustolls	Mollisols.
Duroc	Fine-silty, mixed, mesic	Pachic Haplustolls	Mollisols.
Epping	Loamy, mixed (calcareous), mesic, shallow	Ustic Torriorthents	Entisols.
Glenberg	Coarse-loamy, mixed (calcareous), mesic	Ustic Torrifluvents	Entisols.
Haverson	Fine-loamy, mixed (calcareous), mesic	Ustic Torrifluvents	Entisols.
Hisle	Fine, mixed, mesic	Ustollic Natrargids	Aridisols.
Hoven	Fine, montmorillonitic, mesic	Typic Natraquolls	Mollisols.
Huggins	Fine, mixed, mesic	Aridic Argiustolls	Mollisols.
Imlay	Loamy-skeletal, mixed (calcareous), mesic, shallow	Ustic Torriorthents	Entisols.
Kadoka	Fine-silty, mixed, mesic	Aridic Argiustolls	Mollisols.
Keota	Coarse-silty, mixed (calcareous), mesic	Ustic Torriorthents	Entisols.
Keya	Fine-loamy, mixed, mesic	Pachic Argiustolls	Mollisols.
Kolls	Very-fine, montmorillonitic (calcareous), mesic	Vertic Haplaquolls	Mollisols.
Kube	Fine, mixed, mesic	Aridic Argiustolls	Mollisols.
Kyle	Very-fine, montmorillonitic, mesic	Ustertic Camborthids	Aridisols.
Lakoma	Fine, montmorillonitic, mesic	Typic Ustochrepts	Inceptisols.
Larvie	Very-fine, montmorillonitic, mesic	Ustertic Camborthids	Aridisols.
Lowry	Coarse-silty, mixed, mesic	Typic Haplustolls	Mollisols.
Manter	Coarse-loamy, mixed, mesic	Aridic Argiustolls	Mollisols.
Metre	Very-fine, montmorillonitic, mesic	Torrertic Haplustolls	Mollisols.
Millboro	Fine, montmorillonitic, mesic	Vertic Argiustolls	Mollisols.
Minatare	Fine, mixed, mesic	Aquic Natrargids	Aridisols.
Mitchell	Coarse-silty, mixed (calcareous), mesic	Ustic Torriorthents	Entisols.
Mosher	Fine, montmorillonitic, mesic	Typic Natrustolls	Mollisols.
Murdo	Loamy-skeletal, mixed, mesic	Aridic Argiustolls	Mollisols.
Norrest	Fine, mixed, mesic	Ustollic Haplargids	Aridisols.
Okreek	Very-fine, montmorillonitic, mesic	Vertic Argiustolls	Mollisols.
Opal	Very-fine, montmorillonitic, mesic	Vertic Haplustolls	Mollisols.
Orella	Clayey, mixed (calcareous), mesic, shallow	Ustic Torriorthents	Entisols.
Promise	Very-fine, montmorillonitic, mesic	Vertic Haplustolls	Mollisols.
Ree	Fine-loamy, mixed, mesic	Typic Argiustolls	Mollisols.
Reliance	Fine, mixed, mesic	Typic Argiustolls	Mollisols.
Samsil	Clayey, montmorillonitic (calcareous), mesic, shallow	Ustic Torriorthents	Entisols.
Savo	Fine, mixed, mesic	Aridic Argiustolls	Mollisols.
Schamber	Sandy-skeletal, mixed, mesic	Ustic Torriorthents	Entisols.
Stirk	Very-fine, montmorillonitic (calcareous), mesic	Vertic Ustifluvents	Entisols.
Tuthill	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Aridic Argiustolls	Mollisols.
Valentine	Mixed, mesic	Typic Ustipsamments	Entisols.
Wanblee	Fine, mixed, mesic	Ustollic Natrargids	Aridisols.
Whitelake	Coarse-loamy, mixed, mesic	Typic Natrustolls	Mollisols.
Woodly	Fine-loamy, mixed, mesic	Pachic Argiustolls	Mollisols.
Wortman	Fine, mixed, mesic	Typic Natrustolls	Mollisols.

of the major horizons and in major soil properties. The horizons considered are those in which clay, iron, or humus have accumulated and those in which pans that interfere with the growth of roots and the movement of water have formed. The properties are soil temperature, chemical composition (mainly content of calcium, magnesium, sodium, and potassium), and the like. The great group is not shown separately in table 7 because it is the last word in the name of the subgroup.

SUBGROUP.—Each great group is divided into subgroups, one that represents the central (typic) concept properties used are mainly those that reflect either the presence or absence of waterlogging or differences in climate or vegetation.

GREAT GROUP.—Each suborder is divided into great groups, one that represents the central (typic) concept of the group, and others, called intergrades, that have one or more properties of another great group, suborder, or order. Subgroups also are used to represent a group that has soil properties that intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the great group.

FAMILY.—Families are established within each subgroup, primarily on the basis of properties important to the growth of plants or properties significant in engineering. Texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence are among the properties considered.

SERIES.—A series is a group of soils that have horizons similar in all important characteristics, except for tex-

ture of the surface layer, and similar in arrangement in the profile. (See the section "How This Survey Was Made.")

General Nature of the County

Mellette County was created in 1909 by an act of the South Dakota legislature and was organized in 1911. It was named in honor of the first governor of South Dakota, Arthur C. Mellette. White River is the county seat. Wood is the second largest town. Rural post offices and stores are at Cedar Butte, Mosher, and Norris.

The federal census for 1960 lists the population of the county as 2,664. This represents a 12 percent decrease from the population of 1950. About 29 percent of the population is Indian.

U.S. Highway 83, the main access to the central area of the county, crosses the county from north to south, passing through the town of White River. Other highways that serve the county are State Highways 40 and 53.

Most cattle marketing is done through auction barns located outside of the county. Wheat and other grains are marketed at towns outside the county that are served by the railroad.

Numerous stockwater ponds and the Little White River provide fishing and other recreational facilities.

Relief and Drainage

Mellette County lies in the White River drainage basin. The east-flowing White River forms the northern boundary of the county. About halfway across the county it is joined by the Little White River, which flows north across the middle of the county. Creeks in the south-central part of the county flow to the Little White River; the rest flow to the White River.

Approximately a third of the county is very hilly or is badland. About 7 percent of the landscape is bottom land, which is either nearly level, continuous surfaces or isolated segments cut by meander channels. The rest is nearly equally divided into hilly, rolling, undulating, and nearly level uplands. Hilly areas make up 14 percent of the total area of the county; rolling areas, 14 percent; undulating areas, 19 percent; and nearly level areas, 13 percent.

The lowest elevation in the county, 1,630 feet above sea level, is in the northeast corner of the county, and the highest elevation, about 2,800 feet, is near the southwest corner. The elevation decreases to the north and east. Thus, the southwest corner is nearly 800 feet higher than the northwest corner, is 600 feet higher than the southeast corner, and is about 1,200 feet higher than the northeast corner.

Climate [8]

Mellette County has a continental type climate. Winters are cold and summers are hot. The precipitation is usually light in winter and marginal for adapted crops during the growing season. No large bodies of water or physical features affect the climate.

The climatic summary for this county, for the most part, is based on the 53 years of weather data recorded at Wood from 1913 to 1965. Wood, located in the southeastern part of the county, is at an elevation of 2,180 feet. The climate there is believed to be representative of the county; the annual precipitation in the western part of the county, however, is about 2 inches less than that in the east. The average annual temperature over the county is expected to be within about 1 degree of that at Wood.

Temperature varies widely from summer to winter, and occasionally from day to day in this county. Temperatures usually rise to above 100 degrees in summer and drop to 20 degrees below zero or lower in winter. A temperature of 100 degrees or more can be expected, on the average, on about 6 days in July, 5 days in August, and 1 day each in June and September. Temperatures drop to 20 degrees below zero or lower, on the average, about twice a year; the most likely occurrence is in January. A minimum temperature of zero degrees or lower occurs, on the average, about 23 days per year. The temperature may fail to climb above zero during the day, on the average, about 1 day per year.

Probabilities of the last freezing temperatures in spring and the first in fall are shown in table 8. Other temperature data as well as precipitation data can be found in table 9.

The average annual precipitation at Wood is 19.12 inches, 75 percent of which falls during the growing season, from April to September. Thundershowers, the main source of rainfall during the growing season, vary widely in intensity and amount of rainfall. About once a year, a 1-inch fall in 1 hour may occur, and about once in 10 years, 2 inches in 1 hour can be expected. A rainfall of 3 inches in 24 hours can be expected about once in 5 years, and 4 inches in 24 hours about once in 25 years.

Snowfall and snow cover are important in protecting fall-seeded crops, but a heavy snow cover can hinder ranching and farming activities during winter. An average of about 33 inches of snow falls each season at Wood; as much as 74.6 inches fell during the 1952–53 season and as little as 16.2 inches fell in the 1963–64 season. The greatest monthly snowfall was 28.3 inches in March 1953, and the greatest daily snowfall was 20.0 inches in January 1944. Strong winds often accompany snowfall and cause drifts in and near sheltered areas while open areas may be nearly bare.

Official observations of sunshine, wind, and relative humidity are not made in Mellette County. The following summary of these weather elements, based on about 10 years of observations made at Valentine, Nebr., represent conditions in Mellette County. During the growing season, an average of about two-thirds of possible sunshine can be expected. The greatest amount of sunshine, about three-fourths of the possible, occurs in July and August. The least, about half of possible, occurs in April. The relative humidity varies greatly from early morning to afternoon and occasionally from day to day. The annual average relative humidity is about 80 percent in the early morning and about 50 percent in the afternoon.

[8] By WALTER SPUHLER, State climatologist, National Weather Service, U.S. Department of Commerce, South Dakota State University, Brookings, South Dakota.

TABLE 8.—*Probability of last freezing temperatures in spring and first in fall*

[Prepared by William F. Lytle, South Dakota State University. Based on data recorded at Wood, S. Dak., 1913–65]

Probability	Dates for given probability and temperature					
	16° F.	20° F.	24° F.	28° F.	32° F.	36° F.
After a specified date in spring:						
90 percent	Mar. 12	Mar. 23	Mar. 31	Apr. 12	Apr. 25	May 7
70 percent	Mar. 20	Mar. 30	Apr. 8	Apr. 20	May 2	May 14
50 percent	Apr. 4	Apr. 13	Apr. 24	May 4	May 15	May 26
30 percent	Apr. 18	Apr. 27	May 8	May 17	May 27	June 7
10 percent	Apr. 26	May 4	May 16	May 25	June 3	June 13
Before a specified date in fall:						
10 percent	Oct. 9	Oct. 4	Sept. 21	Sept. 5	Aug. 29	Aug. 21
30 percent	Oct. 18	Oct. 11	Sept. 29	Sept. 15	Sept. 8	Aug. 30
50 percent	Nov. 3	Oct. 25	Oct. 16	Oct. 4	Sept. 26	Sept. 17
70 percent	Nov. 19	Nov. 8	Oct. 31	Oct. 23	Oct. 14	Oct. 4
90 percent	Nov. 27	Nov. 15	Nov. 8	Nov. 2	Oct. 23	Oct. 13

TABLE 9.—*Temperature and precipitation*

[Data from Wood, Mellette County, S. Dak., 1927–63]

Month	Temperature				Precipitation						Days with snowfall of 1 inch or more	Days with snow cover of 1 inch or more
	Average daily maximum	Average daily minimum	Two years in 10 will have—		Average total	Record		One year in 10 will have—		Average snowfall		
			Average daily maximum equal to or higher than—	Average daily minimum equal to or lower than—		Maximum total	Minimum total	Less than—	More than—			
	°F.	°F.	°F.	°F.	In.	In.	In.	In.	In.	In.	No.	No.
January	34. 6	8. 7	47. 6	—3. 4	0. 54	2. 53	0. 00	0. 16	1. 12	5. 4	2	2
February	38. 9	12. 5	52. 5	1. 9	. 65	2. 99	0	. 18	1. 46	6. 3	2	3
March	47. 4	20. 6	59. 1	12. 7	1. 17	3. 43	. 08	. 35	2. 18	8. 2	3	3
April	62. 5	33. 6	70. 7	27. 8	2. 12	5. 62	0	. 55	4. 29	2. 9	1	1
May	72. 5	44. 4	80. 9	38. 7	3. 13	8. 84	. 16	1. 14	5. 61	. 1	0	0
June	82. 0	54. 1	90. 4	48. 9	3. 38	8. 13	. 42	1. 21	5. 47	0	0	0
July	91. 7	60. 5	99. 5	55. 0	2. 3	6. 24	. 23	. 67	4. 43	0	0	0
August	90. 1	58. 7	96. 7	54. 2	2. 00	5. 94	. 25	. 66	3. 42	0	0	0
September	80. 4	48. 7	88. 0	43. 7	1. 44	6. 09	. 06	. 17	3. 01	0	0	0
October	67. 8	37. 3	77. 0	31. 0	1. 17	3. 93	0	. 16	2. 62	1. 0	0	0
November	50. 2	23. 8	59. 2	17. 2	. 72	3. 16	0	. 07	1. 70	4. 5	1	1
December	38. 2	13. 4	47. 9	4. 2	. 46	2. 21	0	. 06	. 99	4. 6	1	2
Year	63. 1	34. 7	66. 3	32. 6	19. 10	[1] 33. 79	[2] 8. 92	14. 28	26. 25	33. 0	10	12

[1] In 1915. [2] In 1934.

The annual average windspeed is about 11 miles per hour, and the prevailing direction is from the south in summer and from the north in winter. A windspeed of 50 miles per hour or more may occur during any month, but is most likely to occur during summer in association with thunderstorms. About 11 thunderstorms occur in June and July, about nine in August, eight in May, and four in September. The other months average fewer than this for an annual average of 45.

Hail occasionally accompanies thunderstorms and may be expected in any one location in the county about once in 2 years. Hail is most likely to occur in June, but may also occur in May and July.

The potential water loss from soil, pastures, and crops is indicated by the rate at which water evaporates from a large pan. The average annual evaporation from the Weather Bureau Class A pan is about 56 inches. An average of about 44 inches evaporates from May through October. The annual evaporation from small lakes averages about 39 inches, and the water loss from soil and crops is usually less, depending upon the available soil moisture.

Farming

Production of beef cattle is the main farm enterprise in the county. About two-thirds of the county is strongly sloping to steep and is suited only for grazing. In addition many small, nearly level to sloping areas are surrounded by steeper areas and are not conveniently located for crops.

The trend during the past 40 years has been toward fewer and larger sized farms and ranches. In 1969 Mellette County had 275 farms and ranches, and they averaged 2,710 acres in size. In 1954 there were 350, and they averaged 2,400 acres in size.

On January 1, 1970 (4), cattle on farms and ranches in the county numbered 58,000. Of this number only 700 were dairy cows and heifers kept for milk production. Hogs numbered 6,400, sheep 6,000, and chickens 8,500.

Alfalfa, winter wheat, sorghum, oats, and corn are the major crops. Except for winter wheat and grain sorghum, most crops are planted either for grain or for forage. In dry years oats and corn are harvested for hay and silage. In other years they are harvested for grain.

In 1968 (4), 24,500 acres of alfalfa was harvested for hay, and 5,200 acres was harvested for seed. Also in 1968, 23,500 acres was in winter wheat; 14,600 acres was in sorghum, 3,700 acres of which was harvested for grain; 12,700 acres was in oats; and 6,100 acres was in corn. A smaller acreage was in barley, rye, and spring wheat.

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Glossary

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Chiseling. Tillage of soil with an implement having one or more soil penetrating points that loosen the subsoil and brings *clods* to the surface. A form of emerging tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Contour farming. Plowing, cultivating, planting, and harvesting in rows that are at right angles to the natural direction of the slope or that are parallel to terrace grade.

Contour stripcropping. Growing crops in strips that follow the contour or are parallel to terraces or diversions. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Crop residue management. A system of retaining crop residue on land between harvest and replanting to prevent erosion and insure future crop production.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation, but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Emergency tillage. Cultivation by listing, ridging, duckfooting, chiseling, pitting, basin listing, or other means to roughen the soil surface for temporary control of wind erosion.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, and covered by grass for protection against erosion; used to conduct surface water away from cropland.

Green manure crop. A crop grown for the purpose of being turned under in an early stage of maturity or soon after maturity for soil improvement.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Loess. Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.

Mapping unit. Areas of soil of the same kind outlined on the soil map and identified by a symbol.

Minimum tillage. The least amount of tillage required for quick germination and a good stand. Several implements may be drawn behind the tractor to reduce the number of times it is driven over the field, but it does not imply that primary tillage, secondary tillage, fertilization, and seeding must be done in one trip across the field.

Organic matter. A general term for plant and animal material, in or on the soil, in all stages of decomposition. Readily decomposed organic matter is often distinguished from the more stable forms that are past the stage of rapid decomposition.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Phase, soil. The subdivision of a soil, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil type, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Runoff (hydraulics). The part of the precipitation upon a drainage area that is discharged from the area in stream channels. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called groundwater runoff or seepage flow from ground water.

Saline soil. A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Stubble mulch. Stubble or other crop residues left on the soil, or partly worked into the soil, to provide protection from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface layer. A term used in nontechnical soil descriptions for one or more layers above the subsoil. Includes A horizon and part of the B horizon; has no depth limit.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand,*

sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Type, soil. A subdivision of the soil series that is made on the basis of differences in the texture of the surface layer.

Wind stripcropping. Growing crops in strips that run crosswise to the general direction of prevailing wind and without strict adherence to the contour of the land.

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GUIDE TO MAPPING UNITS

For complete information about a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. In referring to a capability unit, read the introduction to the section it is in for general information about its management. Windbreak groups are described on pages 68 and 69. Other information is given in tables as follows:

Acreage and extent, table 1, page 9.
Predicted yields, table 2, page 66.

Engineering uses of the soils, tables 4, 5, and 6, pages 72 through 102.

Map symbol	Mapping unit	Page	Range site		Capability unit		Windbreak group
			Name	Page	Symbol	Page	Number
AlC	Altvan loam, 5 to 9 percent slopes	8	Silty	56	IVe-5	63	6
Ba	Badland	10					
	Barren badland part	--	----	--	VIIIs-2	65	--
	Imlay part	--	Shallow	57	VIIs-1	65	10
	Norrest part	--	Clayey	56	VIe-3	64	10
Bg	Bankard and Glenberg soils	11					
	Bankard part	--	Sands	56	VIe-8	64	10
	Glenberg part	--	Overflow	55	IIIe-7	62	2
Bk	Barren badland	11	----	--	VIIIs-2	65	--
Bp	Blackpipe soils	12	Silty	56	IIc-2	60	3
Br	Buffington silty clay loam	13	Silty	56	IIc-2	60	3
Bs	Buffington silty clay loam, channeled	13	Overflow	55	VIw-1	64	10
Bt	Buffington silty clay	13	Clayey	56	IIIs-3	62	4
Bu	Buffington silty clay, channeled	13	Overflow	55	VIw-1	64	10
Bv	Buffington clay	13	Clayey	56	IIIs-3	62	4
Bw	Buffington soils, channeled	13	Overflow	55	VIw-1	64	10
Bx	Buffington-Minatare complex	13					
	Buffington part	--	Clayey	56	IIIs-3	62	3
	Minatare part	--	Thin Claypan	58	VIs-1	65	10
CaB	Caputa loam, 2 to 5 percent slopes	14	Silty	56	IIe-1	60	3
CaC	Caputa loam, 5 to 9 percent slopes	14	Silty	56	IIIe-1	61	3
Ce	Cedar Butte association	15	Claypan	57	IVs-3	64	9
ClE	Conata-Larvie clays, 9 to 25 percent slopes	16	----	--	VIs-3	65	10
	Conata part	--	Shallow	57	----	--	--
	Larvie part	--	Clayey	56	----	--	--
DsC	Dunday loamy fine sand, 6 to 9 percent slopes	16	Sands	56	VIe-7	64	10
DtB	Dunday and Anselmo soils, 0 to 6 percent slopes	16					
	Dunday part	--	Sands	56	VIe-7	64	10
	Anselmo part	--	Sandy	56	IIIe-8	62	5
DuD	Dunday and Valentine soils, 9 to 15 percent slopes	17	Sands	56	VIe-7	64	10
DvA	Duroc and Kadoka silt loams, 0 to 2 percent slopes	17	Silty	56	IIc-2	60	3
DvB	Duroc and Kadoka silt loams, 2 to 5 percent slopes	17	Silty	56	IIe-1	60	3
EhD	Epping-Huggins silt loams, 5 to 15 percent slopes	18	----	--	VIs-2	65	10
	Epping part	--	Shallow	57	----	--	--
	Huggins part	--	Silty	56	----	--	--
EhE	Epping-Huggins silt loams, 15 to 40 percent slopes	18	----	--	VIIs-1	65	10
	Epping part	--	Shallow	57	----	--	--
	Huggins part	--	Silty	56	----	--	--
Ge	Glenberg fine sandy loam	19	Sandy	56	IIIe-7	62	2
Ha	Haverson silt loam	19	Silty	56	IIc-1	60	1

Map symbol	Mapping unit	Page	Range site		Capability unit		Windbreak group
			Name	Page	Symbol	Page	Number
Hc	Haverson silt loam, channeled	20	Overflow	55	VIw-1	64	10
Hd	Haverson silty clay loam	20	Overflow	55	IIc-1	60	1
He	Haverson soils	20	Overflow	55	IIc-1	60	1
HlD	Hisle and Orella soils, 0 to 15 percent slopes	21					
	Hisle part	--	Thin Claypan	58	VIs-1	65	10
	Orella part	--	Shallow	57	VIs-3	65	10
HnB	Huggins silt loam, 2 to 5 percent slopes	22	Silty	56	IIIe-12	62	4
HnC	Huggins silt loam, 5 to 9 percent slopes	22	Silty	56	IVe-3	63	4
HpD	Huggins-Epping silt loams, 5 to 15 percent slopes	22	----	--	VIe-3	64	10
	Huggins part	--	Silty	56	----	--	--
	Epping part	--	Shallow	57	----	--	--
HuA	Huggins-Kadoka silt loams, 0 to 2 percent slopes	22	Silty	56	IIIs-5	62	--
	Huggins part	--	----	--	----	--	4
	Kadoka part	--	----	--	----	--	3
HuB	Huggins-Kadoka silt loams, 2 to 5 percent slopes	22	Silty	56	IIIe-12	62	--
	Huggins part	--	----	--	----	--	4
	Kadoka part	--	----	--	----	--	3
HwB	Huggins and Wortman silt loams, 2 to 5 percent slopes	23					
	Huggins part	--	Silty	56	IIIe-12	62	4
	Wortman part	--	Claypan	57	IVs-3	64	9
Ib	Imlay-Badland association	23	Shallow	57	VIIs-1	65	10
	Imlay part	--	----	--	VIIIs-2	65	--
	Badland part	--					
IcD	Imlay and Conata soils, 6 to 15 percent slopes	23	Shallow	57	VIs-2	65	10
IcE	Imlay and Conata soils, 15 to 40 percent slopes	24	Shallow	57	VIIs-1	65	10
InE	Imlay-Norrest silt loams, 9 to 25 percent slopes	24	----	--	VIIs-1	65	10
	Imlay part	--	Shallow	57	----	--	--
	Norrest part	--	Clayey	56	----	--	--
Ka	Kadoka-Kube silt loams	25	Silty	56	IIc-2	60	3
KeD	Keota-Epping silt loams, 9 to 15 percent slopes	26	----	--	VIe-3	64	10
	Keota part	--	Thin Upland	57	----	--	--
	Epping part	--	Shallow	57	----	--	--
Kh	Kolls and Hoven soils	27	Closed Depression	56	VIs-1	65	10
Ky	Kyle clay	28	Clayey	56	IIIe-4	61	4
LaD	Lakoma-Murdo complex, 9 to 15 percent slopes	29	----	--	VIe-4	64	10
	Lakoma part	--	Clayey	56	----	--	--
	Murdo part	--	Shallow to Gravel	58	----	--	--
LdD	Lakoma-Samsil clays, 5 to 15 percent slopes	29	----	--	VIe-4	64	10
	Lakoma part	--	Clayey	56	----	---	--
	Samsil part	--	Shallow	57	----	--	--
LdE	Lakoma-Samsil clays, 15 to 40 percent slopes	29	----	--	VIIe-2	65	10
	Lakoma part	--	Clayey	56	----	--	--
	Samsil part	--	Shallow	57	----	--	--
LeC	Larvie clay, 5 to 9 percent slopes	30	Clayey	56	IVe-4	63	4

Map symbol	Mapping unit	Page	Range site		Capability unit		Windbreak group
			Name	Page	Symbol	Page	Number
LfC	Larvie-Conata clays, 6 to 15 percent slopes	30	----	--	VIe-4	64	10
	Larvie part	--	Clayey	56	----	--	--
	Conata part	--	Shallow	57	----	--	--
LhC	Larvie and Hisle soils, 0 to 9 percent slopes	30					
	Larvie part	--	Clayey	56	IVe-4	63	4
	Hisle part	--	Thin Claypan	58	VIs-1	65	10
LmB	Larvie-Metre clays, 2 to 5 percent slopes	30	Clayey	56	IIIe-4	61	4
LoA	Lowry silt loam, 0 to 2 percent slopes	31	Silty	56	IIe-1	60	3
LoB	Lowry silt loam, 2 to 5 percent slopes	31	Silty	56	IIe-1	60	3
Ls	Lowry-Slickspots complex	31					
	Lowry part	--	Silty	56	IIe-1	60	3
	Slickspots part	--	Thin Claypan	58	VIs-1	65	10
MaD	Manter-Anselmo fine sandy loams, 9 to 15 percent slopes	32	Sandy	56	VIe-6	64	10
McE	Manter-Samsil complex, 9 to 25 percent slopes	32	----	--	VIe-6	64	10
	Manter part	--	Sandy	56	----	--	--
	Samsil part	--	Shallow	57	----	--	--
MfC	Manter-Tuthill fine sandy loams, 6 to 9 percent slopes	32	Sandy	56	IVe-8	63	5
MlB	Millboro-Reliance complex, 2 to 5 percent slopes	33	----	--	IIIe-4	61	--
	Millboro part	--	Clayey	56	----	--	4
	Reliance part	--	Silty	56	----	--	3
MlC	Millboro-Reliance complex, 5 to 9 percent slopes	33	----	--	IVe-4	63	--
	Millboro part	--	Clayey	56	----	--	4
	Reliance part	--	Silty	56	----	--	3
Mm	Minatare soils	34	Thin Claypan	58	VIs-1	65	10
Mn	Mitchell silt loam	35	Thin Upland	57	IIIe-5	62	8
Mo	Mosher soils	36	Claypan	57	IVs-2	64	9
MrC	Murdo gravelly loam, 2 to 9 percent slopes	36	Shallow to Gravel	58	VIs-4	65	10
MsD	Murdo-Lakoma complex, 6 to 15 percent slopes	36	----	--	VIs-4	65	10
	Murdo part	--	Shallow to Gravel	58	----	--	--
	Lakoma part	--	Clayey	56	----	--	--
MuD	Murdo-Schamber gravelly loams, 9 to 15 percent slopes	36	----	--	VIs-4	65	10
	Murdo part	--	Shallow to Gravel	58	----	--	--
	Schamber part	--	Very Shallow	58	----	--	--
NlC	Norrest silt loam, 5 to 9 percent slopes	37	Clayey	56	IVe-3	63	4
Nm	Norrest-Badland association	37					
	Norrest part	--	Clayey	56	IVe-3	63	4
	Badland part	--	----	--	VIIIs-2	65	4
NoA	Norrest-Blackpipe silt loams, 0 to 2 percent slopes	39	----	--	IIIs-5	62	--
	Norrest part	--	Clayey	56	----	--	4
	Blackpipe part	--	Silty	56	----	--	3
NoB	Norrest-Blackpipe silt loams, 2 to 5 percent slopes	38	----	--	IIIe-12	62	--
	Norrest part	--	Clayey	56	----	--	4
	Blackpipe part	--	Silty	56	----	--	3

Map symbol	Mapping unit	Page	Range site		Capability unit		Windbreak group
			Name	Page	Symbol	Page	Number
NrC	Norrest-Cedar Butte silt loams, 3 to 9 percent slopes	38	----	--	IVe-3	63	--
	Norrest part	--	Clayey	56	----	--	4
	Cedar Butte part	--	Claypan	57	----	--	9
NsC	Norrest-Imlay silt loams, 5 to 9 percent slopes	38					
	Norrest part	--	Clayey	56	IVe-3	63	4
	Imlay part	--	Shallow	57	VIs-2	65	10
NsD	Norrest-Imlay silt loams, 9 to 15 percent slopes	38	----	--	VIe-3	64	10
	Norrest part	--	Clayey	56	----	--	--
	Imlay part	--	Shallow	57	----	--	--
NtB	Norrest and Okreek soils, 2 to 5 percent slopes	38	Clayey	56	IIIe-12	62	4
OcC	Opal clay, 5 to 9 percent slopes	40	Clayey	56	IVe-4	63	4
OgC	Opal clay, mounded, 5 to 9 percent slopes	40	Clayey	56	IVe-4	63	4
OlB	Opal-Caputa complex, 2 to 5 percent slopes	40					
	Opal part	--	Clayey	56	IIIe-4	61	4
	Caputa part	--	Silty	56	IIIe-4	61	3
OlC	Opal-Caputa complex, 5 to 9 percent slopes	40					
	Opal part	--	Clayey	56	IVe-4	63	4
	Caputa part	--	Silty	56	IVe-4	63	3
OmB	Opal-Mosher complex, 2 to 6 percent slopes	40					
	Opal part	--	Clayey	56	IIIe-4	61	4
	Mosher part	--	Claypan	57	IIIe-4	61	9
OpB	Opal-Promise clays, 2 to 5 percent slopes	40	Clayey	56	IIIe-4	61	4
OtB	Opal-Tuthill complex, 2 to 5 percent slopes	40	----	--	IIIe-4	--	--
	Opal part	--	Clayey	56	----	61	4
	Tuthill part	--	Sandy	56	----	61	5
OtD	Opal-Tuthill complex, 5 to 15 percent slopes	41	----	--	VIe-4	--	10
	Opal part	--	Clayey	56	----	64	--
	Tuthill part	--	Sandy	56	----	64	--
OwC	Opal-Woodly complex, 3 to 9 percent slopes	41	----	--	IVe-4	--	--
	Opal part	--	Clayey	56	----	63	4
	Woodly part	--	Sandy	56	----	63	5
Ox	Orella-Badland complex	41					
	Orella part	--	Shallow	57	VIs-3	65	10
	Badland part	--	----	--	VIIIs-2	65	--
PcA	Promise clay, 0 to 2 percent slopes	42	Clayey	56	IIIs-3	62	4
PcB	Promise clay, 2 to 5 percent slopes	42	Clayey	56	IIIe-4	61	4
Pd	Promise soils	42	Overflow	55	IIIs-3	62	4
PgA	Promise and Opal clays, 0 to 2 percent slopes	42	Clayey	56	IIIs-3	62	4
PgB	Promise and Opal clays, 2 to 5 percent slopes	43	Clayey	56	IIIe-4	61	4
PmA	Promise-Mosher complex, 0 to 2 percent slopes	43	----	--	IIIs-3	--	--
	Promise part	--	Clayey	56	----	62	4
	Mosher part	--	Claypan	57	----	62	9
Ps	Promise soils and Slickspots	44					
	Promise part	--	Overflow	55	IIIs-3	62	4
	Slickspots part	--	Thin Claypan	58	VIs-1	65	10
ReB	Ree loam, 2 to 5 percent slopes	44	Silty	56	IIe-1	60	3

Map symbol	Mapping unit	Page	Range site		Capability unit		Windbreak group
			Name	Page	Symbol	Page	Number
RkA	Ree and Keya loams, 0 to 2 percent slopes---	44	----	--	IIc-2	--	--
	Ree part----------	--	Silty	56	----	60	3
	Keya part----------	--	Overflow	55	----	60	1
RkB	Ree and Keya loams, 2 to 5 percent slopes---	45	Silty	--	IIe-1	--	--
	Ree part----------	--	----	56	----	60	3
	Keya part----------	--	----	56	----	60	1
SaE	Samsil clay, 15 to 40 percent slopes--------	46	Shallow	57	VIIs-2	65	10
SlD	Samsil-Lakoma clays, 9 to 15 percent slopes----------	46	----	--	VIs-3	--	10
	Samsil part----------	--	Shallow	57	----	65	--
	Lakoma part----------	--	Clayey	56	----	65	--
SlE	Samsil-Lakoma clays, 15 to 40 percent slopes----------	47	----	--	VIIs-2	--	10
	Samsil part----------	--	Shallow	57	----	65	--
	Lakoma part----------	--	Clayey	56	----	65	--
SmE	Samsil-Manter complex, 15 to 40 percent slopes----------	47	----	--	VIIs-2	--	10
	Samsil part----------	--	Shallow	57	----	65	--
	Manter part----------	--	Sandy	56	----	65	--
SnE	Samsil-Schamber complex, 15 to 40 percent slopes----------	47	----	--	VIIs-2	65	10
	Samsil part----------	--	Shallow	57	----	--	--
	Schamber part----------	--	Very Shallow	58	----	--	--
Ss	Samsil-Shale outcrop complex----------	47					
	Samsil part----------	--	Shallow	57	VIIs-2	65	10
	Shale outcrop part----------	--	----	--	VIIIs-2	65	--
St	Sandy land----------	47	Sands	56	VIe-7	64	10
SuA	Savo silty clay loam, 0 to 2 percent slopes----------	48	Silty	56	IIc-2	60	3
SuB	Savo silty clay loam, 2 to 5 percent slopes----------	48	Silty	56	IIe-1	60	3
SuC	Savo silty clay loam, 5 to 9 percent slopes----------	48	Silty	56	IIIe-1	61	3
SvE	Schamber-Murdo gravelly loams, 15 to 25 percent slopes----------	49	----	--	VIIs-4	65	10
	Schamber part----------	--	Very Shallow	58	----	--	--
	Murdo part----------	--	Shallow to Gravel	58	----	--	--
SwE	Schamber-Samsil complex, 15 to 40 percent slopes----------	49	----	--	VIIs-4	65	10
	Schamber part----------	--	Very Shallow	58	----	--	--
	Samsil part----------	--	Shallow	57	----	--	--
Sy	Stirk clay----------	49	Overflow	55	VIs-1	65	10
ThB	Tuthill fine sandy loam, 3 to 6 percent slopes----------	50	Sandy	56	IIIe-8	62	5
ToC	Tuthill-Opal complex, 2 to 9 percent slopes----------	50	----	--	IVe-8	63	--
	Tuthill part----------	--	Sandy	56	----	--	5
	Opal part----------	--	Clayey	56	----	--	4
TuB	Tuthill and Whitelake fine sandy loams, 0 to 5 percent slopes----------	50	Sandy	--	----	--	5
	Tuthill part----------	--	----	56	IIIe-8	62	--
	Whitelake part----------	--	----	56	IVe-13	63	--
TwA	Tuthill-Woodly fine sandy loams, 0 to 3 percent slopes----------	50	Sandy	56	IIIe-7	62	5
TwB	Tuthill-Woodly fine sandy loams, 3 to 6 percent slopes----------	50	Sandy	56	IIIe-8	62	5

Map symbol	Mapping unit	Page	Range site		Capability unit		Windbreak group
			Name	Page	Symbol	Page	Number
VaE	Valentine fine sand, 15 to 35 percent slopes	51	Sands	56	VIIe-1	65	10
Wa	Wanblee-Whitelake complex	52					
	Wanblee part	--	Thin Claypan	58	VIs-1	65	10
	Whitelake part	--	Sandy	56	IVe-13	63	5
WbB	Wanblee-Wortman association, 0 to 5 percent slopes	52					
	Wanblee part	--	Thin Claypan	58	VIs-1	65	10
	Wortman part	--	Claypan	57	IVs-3	64	9
Wd	Woodly fine sandy loam	54	Sandy	56	IIIe-7	62	5
WoB	Woodly-Opal complex, 2 to 5 percent slopes	54	----	--	IIIe-8	62	--
	Woodly part	--	Sandy	56	----	--	5
	Opal part	--	Clayey	56	----	--	4
Ww	Wortman and Wanblee silt loams	54					
	Wortman part	--	Claypan	57	IVs-3	64	9
	Wanblee part	--	Thin Claypan	58	VIs-1	65	10

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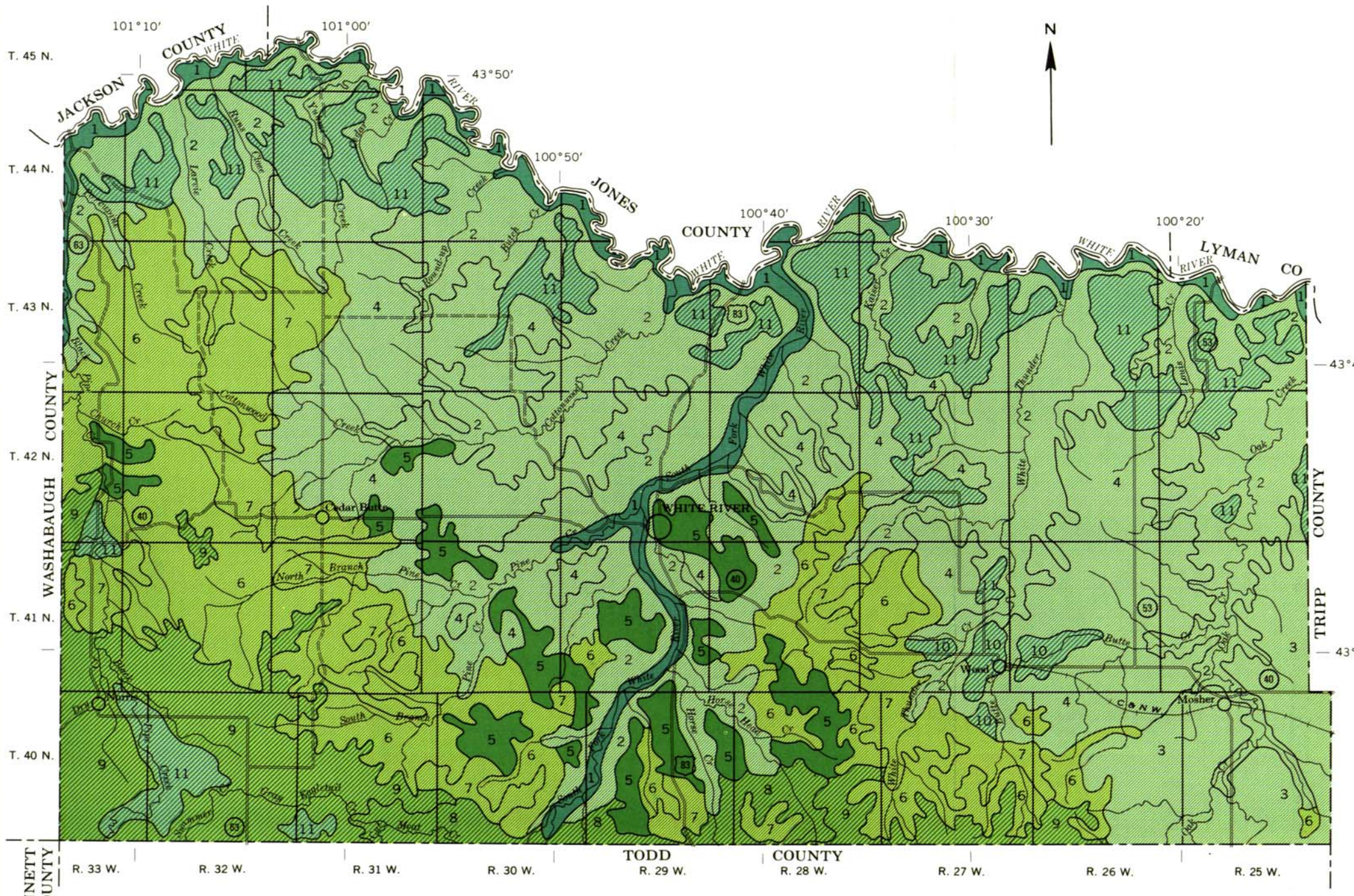


U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

U. S. DEPARTMENT OF THE INTERIOR
BUREAU OF INDIAN AFFAIRS

SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

MELLETTE COUNTY, SOUTH DAKOTA

Scale 1:316,800

1 0 1 2 3 4 5 Miles

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SOIL ASSOCIATIONS

MODERATELY WELL DRAINED AND WELL DRAINED SILTY AND LOAMY SOILS THAT FORMED IN ALLUVIUM; IN STREAM VALLEYS

1 — Haverson-Glenberg association: Deep, nearly level to gently sloping, moderately well drained and well drained silty and loamy soils

MODERATELY WELL DRAINED TO EXCESSIVELY DRAINED CLAYEY SOILS OVER SHALE; ON UPLANDS

2 — Samsil-Lakoma association: Shallow and moderately deep, strongly sloping to steep, well-drained to excessively drained clayey soils

3 — Promise-Millboro association: Deep, nearly level to gently sloping, well-drained clayey soils

4 — Opal-Promise-Samsil association: Shallow to deep, nearly level to strongly sloping, moderately well drained and well drained clayey soils

WELL-DRAINED LOAMY SOILS THAT FORMED IN LOAMY TO SANDY MATERIAL; ON UPLANDS

5 — Tuthill-Manter association: Deep, nearly level to sloping or undulating, well-drained loamy soils

WELL-DRAINED TO EXCESSIVELY DRAINED LOAMY, SILTY, AND CLAYEY SOILS OVER SILTSTONE, MUDSTONE, AND SHALE; ON UPLANDS

6 — Imlay-Conata-Badland association: Shallow, gently sloping to steep, well-drained to excessively drained loamy and clayey soils and areas of Badland

7 — Norrest association: Moderately deep, nearly level to strongly sloping, well-drained silty soils

WELL-DRAINED TO EXCESSIVELY DRAINED SILTY AND LOAMY SOILS OVER SILTSTONE; ON UPLANDS

8 — Epping-Huggins-Imlay association: Shallow to moderately deep, sloping to steep, well-drained to excessively drained silty and loamy soils

9 — Huggins-Kadoka association: Moderately deep, nearly level to strongly sloping, well-drained silty soils

WELL-DRAINED SILTY AND LOAMY SOILS THAT FORMED IN OLD ALLUVIUM; ON TERRACES AND UPLANDS

10 — Savo association: Deep, nearly level to gently sloping, well-drained silty soils

11 — Ree association: Deep, nearly level to gently sloping, well-drained loamy soils

Compiled 1973

INDEX TO MAP SHEETS

MELLETTE COUNTY, SOUTH DAKOTA

Scale 1:316,800

1 0 1 2 3 4 5 Miles

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

MELLETTE COUNTY, SOUTH DAKOTA

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF INDIAN AFFAIRS
SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, or E, shows the slope. Most symbols without a slope letter are those of nearly level soils, but some are for soils and land types that have a considerable range of slope.

SYMBOL	NAME
AlC	Altvan loam, 5 to 9 percent slopes
Ba	Badland
Ba	Bankard and Glenberg soils
Bk	Barren badland
Bp	Blackpipe soils
Br	Buffington silty clay loam
Bs	Buffington silty clay loam, channeled
Bt	Buffington silty clay
Bu	Buffington silty clay, channeled
Bv	Buffington clay
Bw	Buffington soils, channeled
Bx	Buffington-Minatare complex
CaB	Caputa loam, 2 to 5 percent slopes
CaC	Caputa loam, 5 to 9 percent slopes
Ce	Cedar Butte association
CtE	Conata-Larvie clays, 9 to 25 percent slopes
DsC	Dunday loamy fine sand, 6 to 9 percent slopes
DtB	Dunday and Anselmo soils, 0 to 6 percent slopes
DuD	Dunday and Valentine soils, 9 to 15 percent slopes
DvA	Duroc and Kadoka silt loams, 0 to 2 percent slopes
DvB	Duroc and Kadoka silt loams, 2 to 5 percent slopes
EhD	Epping-Huggins silt loams, 5 to 15 percent slopes
EhE	Epping-Huggins silt loams, 15 to 40 percent slopes
Ge	Glenberg fine sandy loam
Ha	Haverson silt loam
Hc	Haverson silt loam, channeled
Hd	Haverson silty clay loam
He	Haverson soils
HlD	Hisle and Orella soils, 0 to 15 percent slopes
HnB	Huggins silt loam, 2 to 5 percent slopes
HnC	Huggins silt loam, 5 to 9 percent slopes
HpD	Huggins-Epping silt loams, 5 to 15 percent slopes
HuA	Huggins-Kadoka silt loams, 0 to 2 percent slopes
HuB	Huggins-Kadoka silt loams, 2 to 5 percent slopes
HwB	Huggins and Wortman silt loams, 2 to 5 percent slopes
Ib	Imlay-Badland association
IcD	Imlay and Conata soils, 6 to 15 percent slopes
IcE	Imlay and Conata soils, 15 to 40 percent slopes
InE	Imlay-Norrest silt loams, 9 to 25 percent slopes
Ka	Kadoka-Kube silt loams
KeD	Keota-Epping silt loams, 9 to 15 percent slopes
Kh	Kolls and Hoven soils
Ky	Kyle clay
LaD	Lakoma-Murdo complex, 9 to 15 percent slopes
LdD	Lakoma-Samsil clays, 5 to 15 percent slopes
LdE	Lakoma-Samsil clays, 15 to 40 percent slopes
LeC	Larvie clay, 5 to 9 percent slopes
LfC	Larvie-Conata clays, 6 to 15 percent slopes
LhC	Larvie and Hisle soils, 0 to 9 percent slopes
LmB	Larvie-Metre clays, 2 to 5 percent slopes
LoA	Lowry silt loam, 0 to 2 percent slopes
LoB	Lowry silt loam, 2 to 5 percent slopes
Ls	Lowry-Slickspots complex
MaD	Manter-Anselmo fine sandy loams, 9 to 15 percent slopes
McE	Manter-Samsil complex, 9 to 25 percent slopes
MfC	Manter-Tuthill fine sandy loams, 6 to 9 percent slopes
MlB	Millboro-Reliance complex, 2 to 5 percent slopes
MlC	Millboro-Reliance complex, 5 to 9 percent slopes
Mm	Minatare soils
Mn	Mitchell silt loam
Mo	Mosher soils
MrC	Murdo gravelly loam, 2 to 9 percent slopes
MsD	Murdo-Lakoma complex, 6 to 15 percent slopes
MuD	Murdo-Schamber gravelly loams, 9 to 15 percent slopes
NlC	Norrest silt loam, 5 to 9 percent slopes
Nm	Norrest-Badland association
NoA	Norrest-Blackpipe silt loams, 0 to 2 percent slopes
NoB	Norrest-Blackpipe silt loams, 2 to 5 percent slopes
NrC	Norrest-Cedar Butte silt loams, 3 to 9 percent slopes
NsC	Norrest-Imlay silt loams, 5 to 9 percent slopes
NsD	Norrest-Imlay silt loams, 9 to 15 percent slopes
NtB	Norrest and Okreek soils, 2 to 5 percent slopes
OcC	Opal clay, 5 to 9 percent slopes
OgC	Opal clay, mounded, 5 to 9 percent slopes
OlB	Opal-Caputa complex, 2 to 5 percent slopes
OlC	Opal-Caputa complex, 5 to 9 percent slopes
OmB	Opal-Mosher complex, 2 to 6 percent slopes
OpB	Opal-Promise clays, 2 to 5 percent slopes
OtB	Opal-Tuthill complex, 2 to 5 percent slopes
OtD	Opal-Tuthill complex, 5 to 15 percent slopes
OwC	Opal-Woodly complex, 3 to 9 percent slopes
Ox	Orella-Badland complex
PcA	Promise clay, 0 to 2 percent slopes
PcB	Promise clay, 2 to 5 percent slopes
Pd	Promise soils
PgA	Promise and Opal clays, 0 to 2 percent slopes
PgB	Promise and Opal clays, 2 to 5 percent slopes
PmA	Promise-Mosher complex, 0 to 2 percent slopes
Ps	Promise soils and Slickspots
ReB	Ree loam, 2 to 5 percent slopes
RkA	Ree and Keya loams, 0 to 2 percent slopes
RkB	Ree and Keya loams, 2 to 5 percent slopes
SaE	Samsil clay, 15 to 40 percent slopes
SlD	Samsil-Lakoma clays, 9 to 15 percent slopes
SlE	Samsil-Lakoma clays, 15 to 40 percent slopes
SmE	Samsil-Manter complex, 15 to 40 percent slopes
SnE	Samsil-Schamber complex, 15 to 40 percent slopes
Ss	Samsil-Shale outcrop complex
St	Sandy land
SuA	Savo silty clay loam, 0 to 2 percent slopes
SuB	Savo silty clay loam, 2 to 5 percent slopes
SuC	Savo silty clay loam, 5 to 9 percent slopes
SvE	Schamber-Murdo gravelly loams, 15 to 25 percent slopes
SwE	Schamber-Samsil complex, 15 to 40 percent slopes
Sy	Stirk clay
ThB	Tuthill fine sandy loam, 3 to 6 percent slopes
ToC	Tuthill-Opal complex, 2 to 9 percent slopes
TuB	Tuthill and Whitelake fine sandy loams, 0 to 5 percent slopes
TwA	Tuthill-Woodly fine sandy loams, 0 to 3 percent slopes
TwB	Tuthill-Woodly fine sandy loams, 3 to 6 percent slopes
VaE	Valentine fine sand, 15 to 35 percent slopes
Wa	Wanblee-Whitelake complex
WbB	Wanblee-Wortman association, 0 to 5 percent slopes
Wd	Woodly fine sandy loam
WoB	Woodly-Opal complex, 2 to 5 percent slopes
Ww	Wortman and Wanblee silt loams

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

Short steep slope

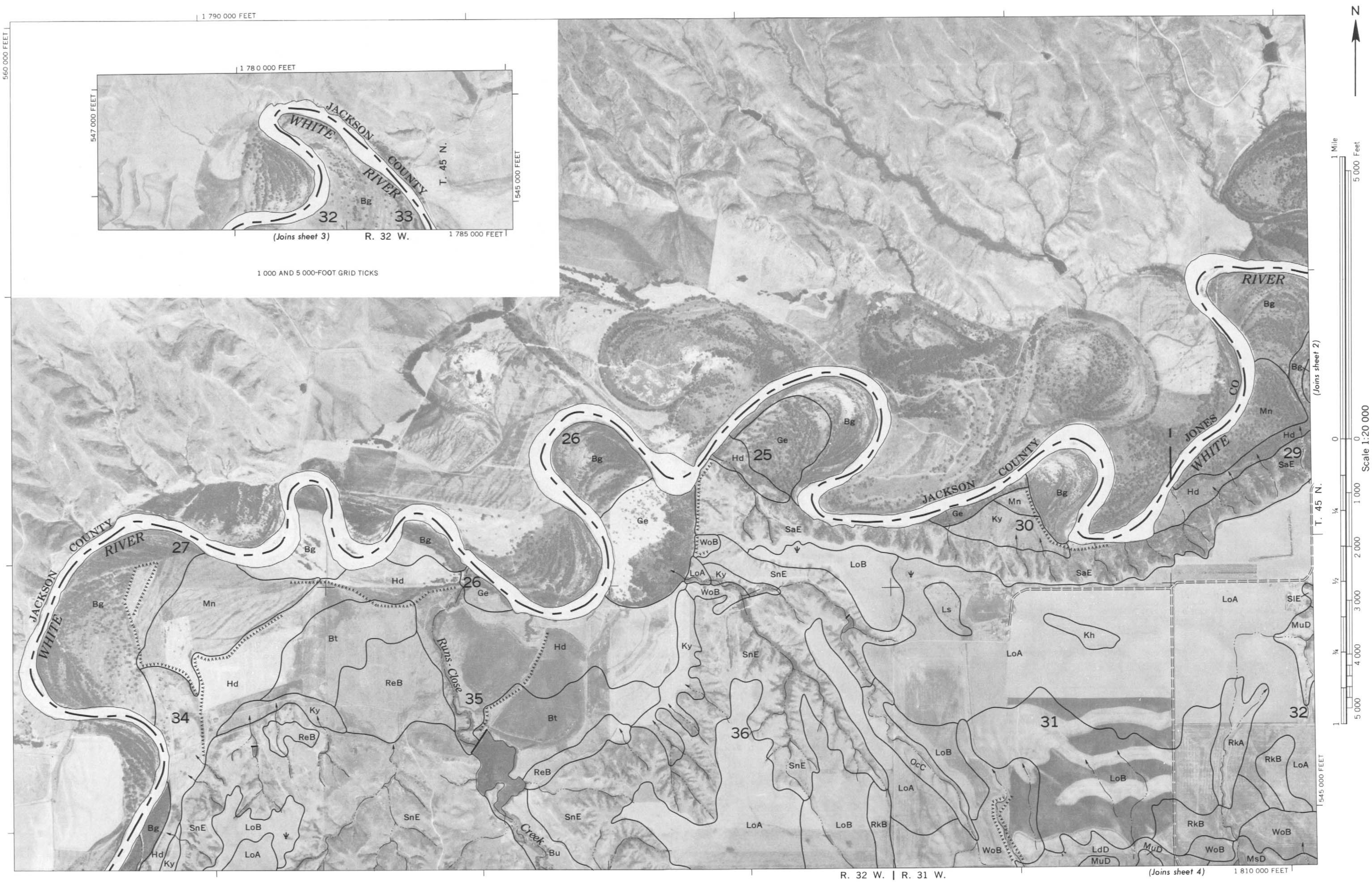
Prominent peak

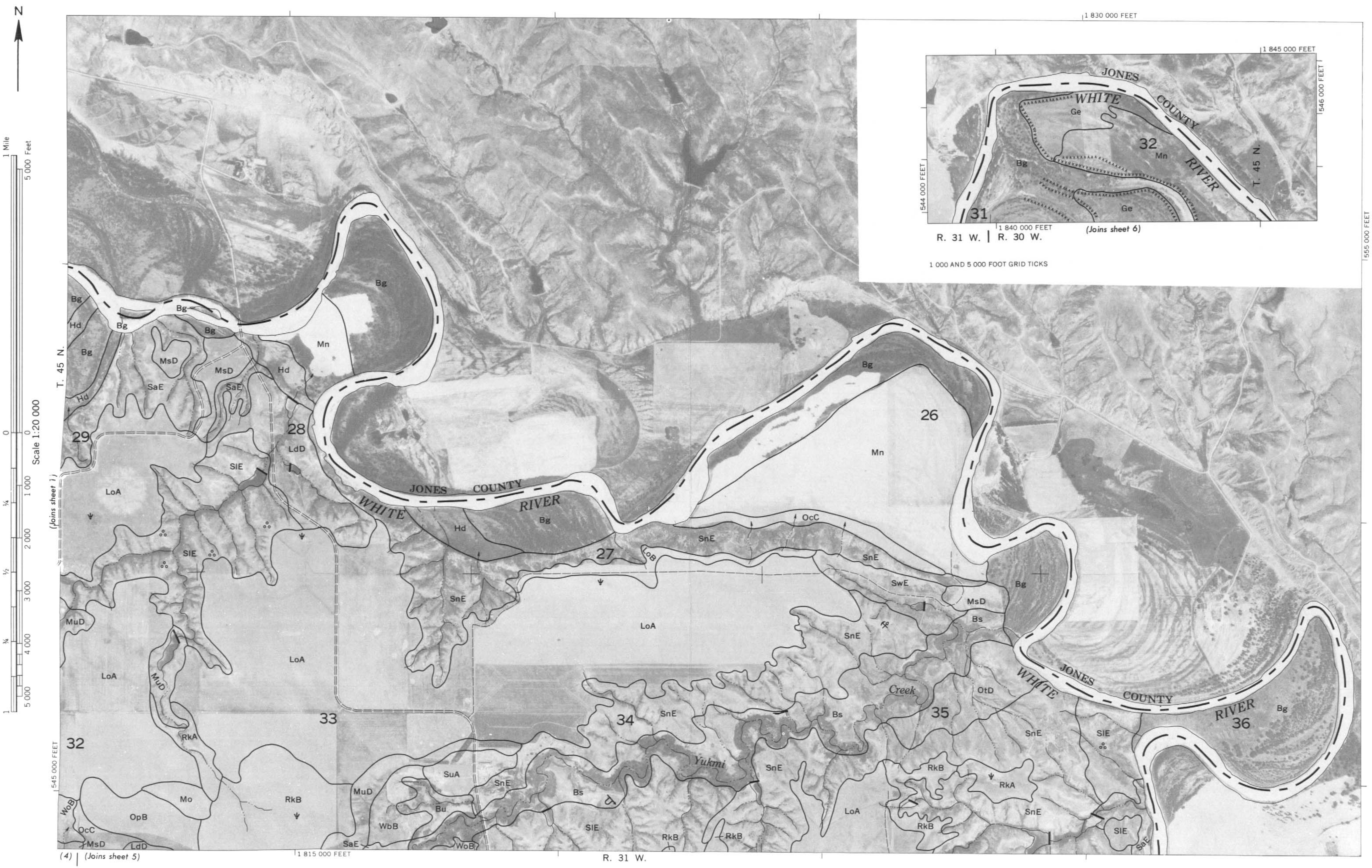
Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness: Stony, Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Dugout


1
N
1 790 000 FEET
560 000 FEET
1 780 000 FEET
547 000 FEET
545 000 FEET
JACKSON COUNTY
WHITE RIVER
T. 45 N.
Bg
32
33
(Joins sheet 3)
R. 32 W.
1 785 000 FEET
1 000 AND 5 000-FOOT GRID TICKS
(Joins sheet 2)
JONES CO
JACKSON COUNTY
WHITE RIVER
Runs Close Creek
25
26
27
29
30
31
32
34
35
36
Bg
Ge
Hd
Mn
Ky
SaE
WoB
LoA
LoB
SnE
Ls
Kh
SlE
MuD
Bt
ReB
OcC
RkB
RkA
LdD
MsD
Bu
T. 45 N.
545 000 FEET
R. 32 W. | R. 31 W.
(Joins sheet 4)
1 810 000 FEET
1 Mile
5 000 Feet
Scale 1:20 000


N
1 Mile
5 000 Feet
Scale 1:20 000
1 830 000 FEET
1 845 000 FEET
546 000 FEET
544 000 FEET
1 840 000 FEET
(Joins sheet 6)
R. 31 W. | R. 30 W.
1 000 AND 5 000 FOOT GRID TICKS
555 000 FEET
545 000 FEET
(Joins sheet 1)
(4) | (Joins sheet 5)
1 815 000 FEET
R. 31 W.
T. 45 N.
JONES COUNTY
WHITE RIVER
Creek
Yukmi
26
27
28
29
31
32
33
34
35
36
Bg
Hd
MsD
SaE
Mn
LdD
SlE
LoA
LoB
OcC
SnE
SwE
Bs
OtD
MuD
RkA
RkB
Ge
SuA
Bu
WbB
WoB
OpB
Mo
SaE

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 3

3

N

1 765 000 FEET

(Joins inset, sheet 1)

540 000 FEET

T. 44 N.

JACKSON COUNTY

WHITE RIVER

WASHABAUGH CO

Bg Ge Ky Ha Bs SnE LoB LoA AlC SlE RkB OcC Bt Mn OmB Mm SaE OwC OtD RkA MsD SwE MuD SvE LoB

6 5 2 16 11 12 10 7 8 15 14 13 18 17

(Joins sheet 4)

(Joins sheet 7)

1 785 000 FEET

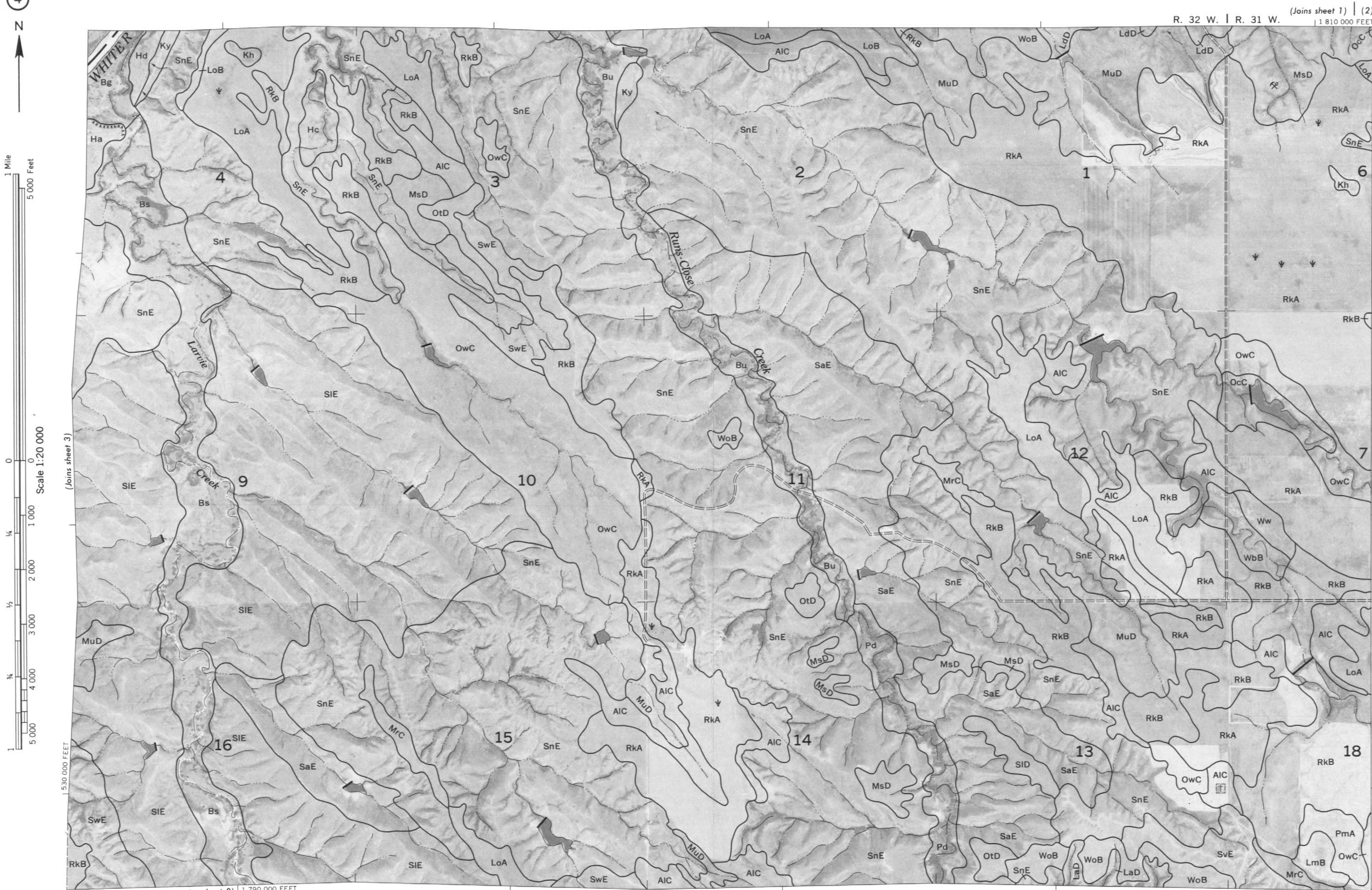
530 000 FEET

R. 33 W. | R. 32 W.

1 Mile

5 000 Feet

Scale 1:20 000


4
N
(Joins sheet 1)
(2)
R. 32 W.
R. 31 W.
1 810 000 FEET
540 000 FEET
T. 44 N.
(Joins sheet 5)
(Joins sheet 3)
(Joins sheet 8)
1 790 000 FEET
530 000 FEET
1 Mile
5 000 Feet
Scale 1:20 000
WHITE R
Runs Close Creek
Larrie Creek

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 5

5

N

R. 31 W.

(Joins sheet 2)

1 815 000 FEET

540 000 FEET

T. 44 N.

(Joins sheet 4)

JONES COUNTY

WHITE RIVER

Yukmi Creek

Cedar Creek

1 830 000 FEET

530 000 FEET

(Joins sheet 6)

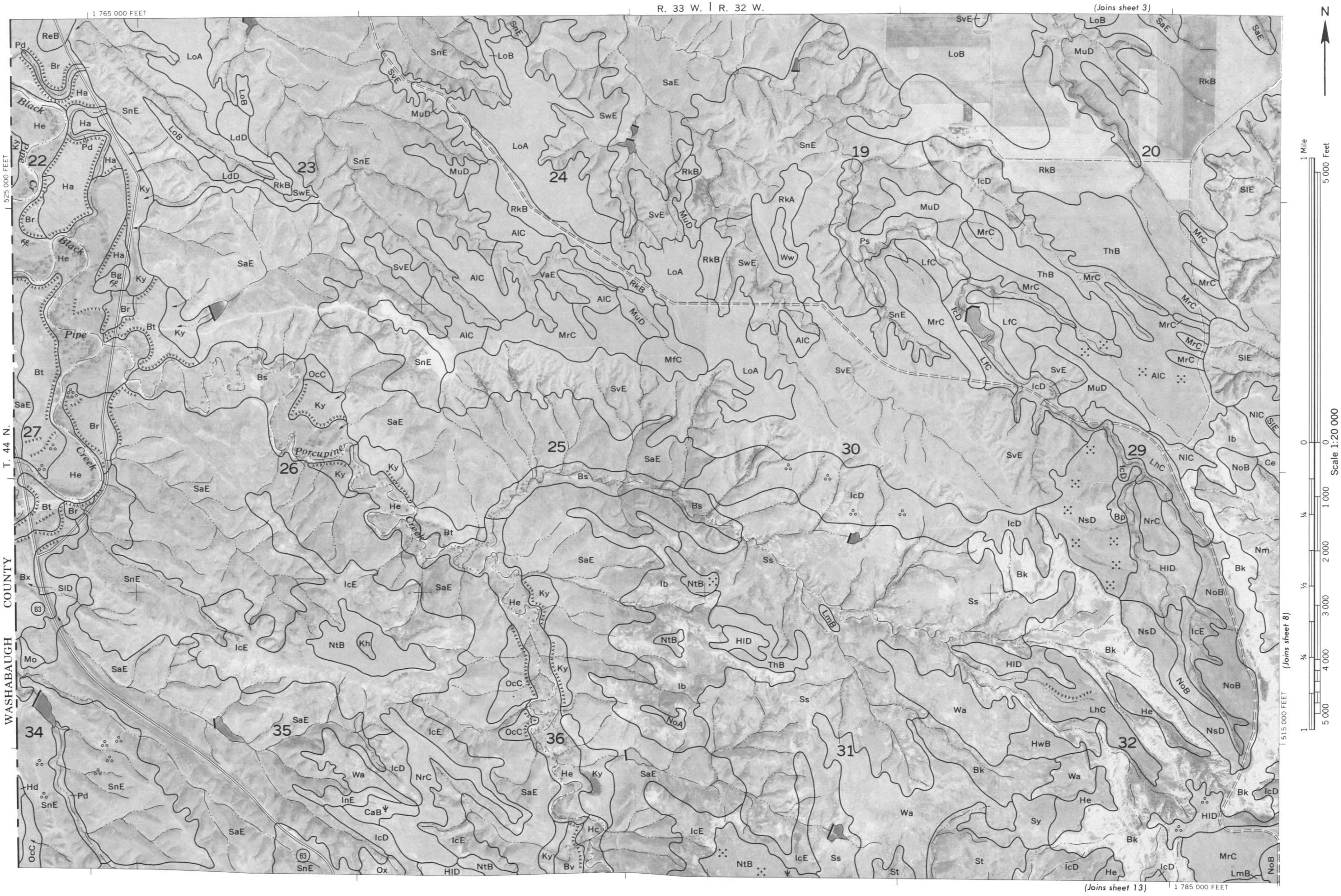
(Joins sheet 9)

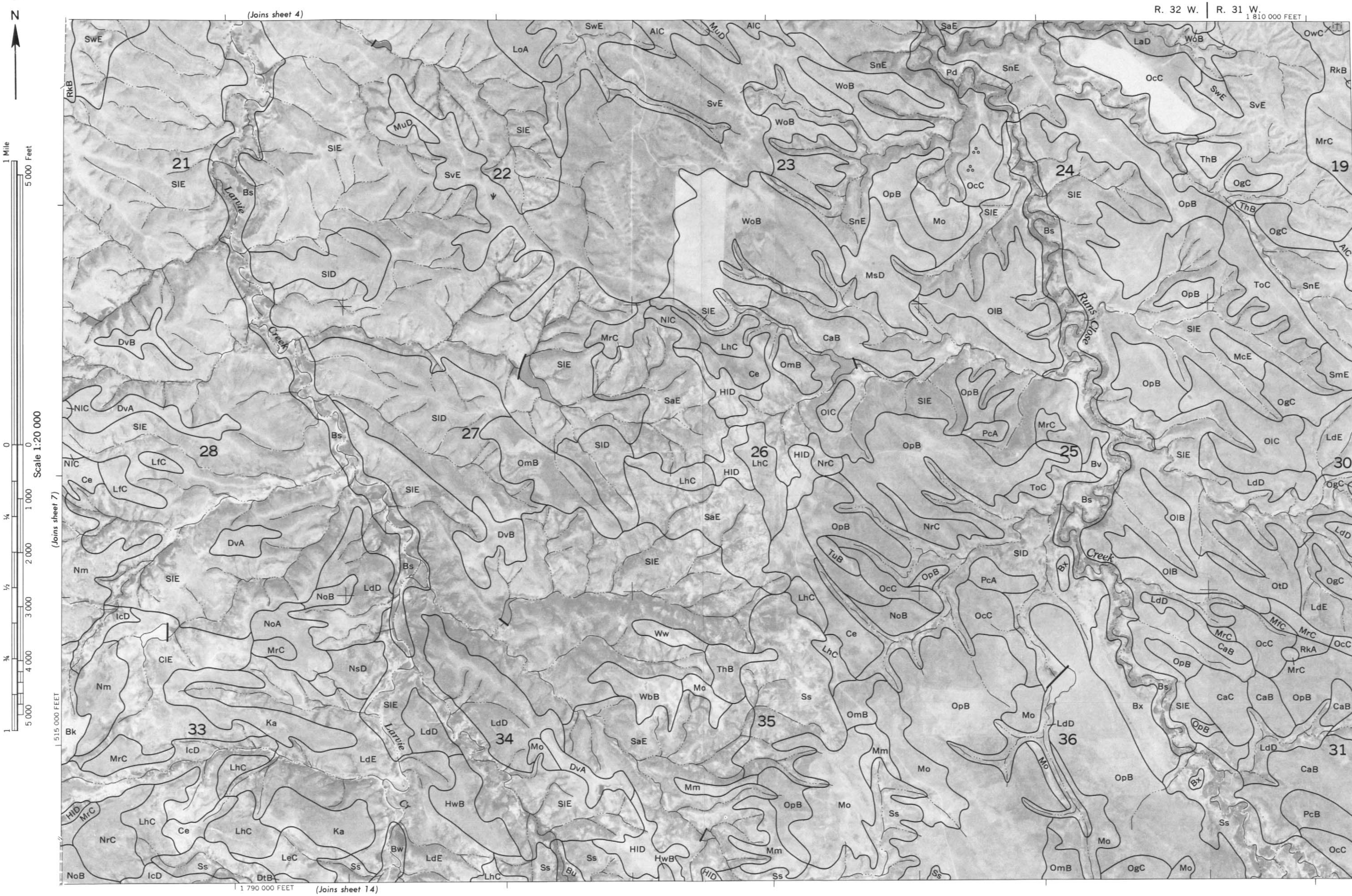
1 Mile

5 000 Feet

Scale 1:20 000

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 6


1 765 000 FEET
R. 33 W. | R. 32 W.
(Joins sheet 3)
N
525 000 FEET
T. 44 N.
WASHABAUGH COUNTY
Black Pipe Cr.
Black Pipe Creek
Porcupine Creek
63
19
20
22
23
24
25
26
27
29
30
31
32
34
35
36
ReB
Pd
Br
Ha
He
Ky
Bg
Bt
Bs
SaE
SnE
LoA
LoB
LdD
RkB
SwE
SvE
MuD
AlC
VaE
MrC
MfC
OcC
RkA
Ww
Ps
LfC
IcD
IcE
ThB
SlE
NlC
Ib
NoB
Ce
Nm
Bk
NsD
Bp
NrC
HlD
LhC
NtB
Kh
HwB
Wa
Sy
Ss
St
LmB
NoA
Mo
Bx
SlD
Hd
InE
CaB
Ox
Bv
Hc
(Joins sheet 8)
515 000 FEET
(Joins sheet 13)
1 785 000 FEET
1 Mile
5 000 Feet
Scale 1:20 000


8
N
(Joins sheet 4)
R. 32 W.
R. 31 W.
1 810 000 FEET
525 000 FEET
T. 44 N.
(Joins sheet 9)
(Joins sheet 7)
515 000 FEET
1 790 000 FEET
(Joins sheet 14)
1 Mile
5 000 Feet
Scale 1:20 000
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1
SwE
LoA
SwE
AlC
MuD
AlC
SaE
LaD
WoB
OwC
RkB
SnE
Pd
SnE
OcC
SwE
SvE
RkB
MuD
SlE
SlE
SvE
WoB
WoB
MrC
21
SlE
Bs
Larrie
SvE
22
23
OcC
SlE
Mo
OpB
SnE
24
SlE
ThB
OgC
19
OpB
ThB
OgC
AlC
WoB
MsD
SlD
Bs
OlB
Runs
Close
ToC
SnE
OpB
SlE
McE
SmE
DvB
Creek
MrC
NlC
SlE
LhC
CaB
SlE
Ce
OmB
HlD
SaE
SlE
OpB
PcA
OgC
OpB
NlC
DvA
SlE
SlD
27
OlC
MrC
OlC
LdE
28
LfC
SlD
OmB
26
LhC
HlD
NrC
HlD
OpB
25
Bv
LdD
30
SlE
OgC
NlC
Ce
LfC
LhC
HlD
SlE
ToC
Bs
OlB
LdD
SaE
OpB
NrC
DvB
DvA
SlE
TuB
OpB
SlD
Bx
Creek
OlB
OgC
OtD
Nm
SlE
NoB
LdD
Bs
LhC
OcC
NoB
PcA
OcC
LdD
LdE
IcD
NoA
MrC
Ce
MfC
MrC
OcC
ClE
MrC
NsD
Ww
ThB
LhC
MrC
CaB
OcC
RkA
Nm
Mo
OpB
MrC
SlE
WbB
Ss
CaC
CaB
OpB
LdD
LdD
OmB
OpB
Mo
Bx
SlE
CaB
Bk
33
Ka
Larrie
34
35
LdD
36
MrC
IcD
Mo
SaE
Mm
Mo
Mo
OpB
LdD
31
LhC
LdE
DvA
Mo
OpB
CaB
Bx
HwB
SlE
Mm
HlD
MrC
LhC
Ce
LhC
Ka
Cr
OpB
Mo
Ss
Ss
PcB
NrC
Bw
HlD
HwB
Mm
Mo
OcC
LeC
Ss
LdE
Ss
Ss
Bu
NoB
IcD
DtB
LhC
HlD
Ss
Ss
OmB
OgC
Mo

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 9

9

N

1 815 000 FEET

R. 31 W.

(Joins sheet 5)

525 000 FEET

T. 44 N.

Big White School

Cedar Creek

Yukmi Creek

19 20 21 22 23 30 29 28 27 26 31 32 33 34 35

(Joins sheet 8)

(Joins sheet 10)

515 000 FEET

1 830 000 FEET

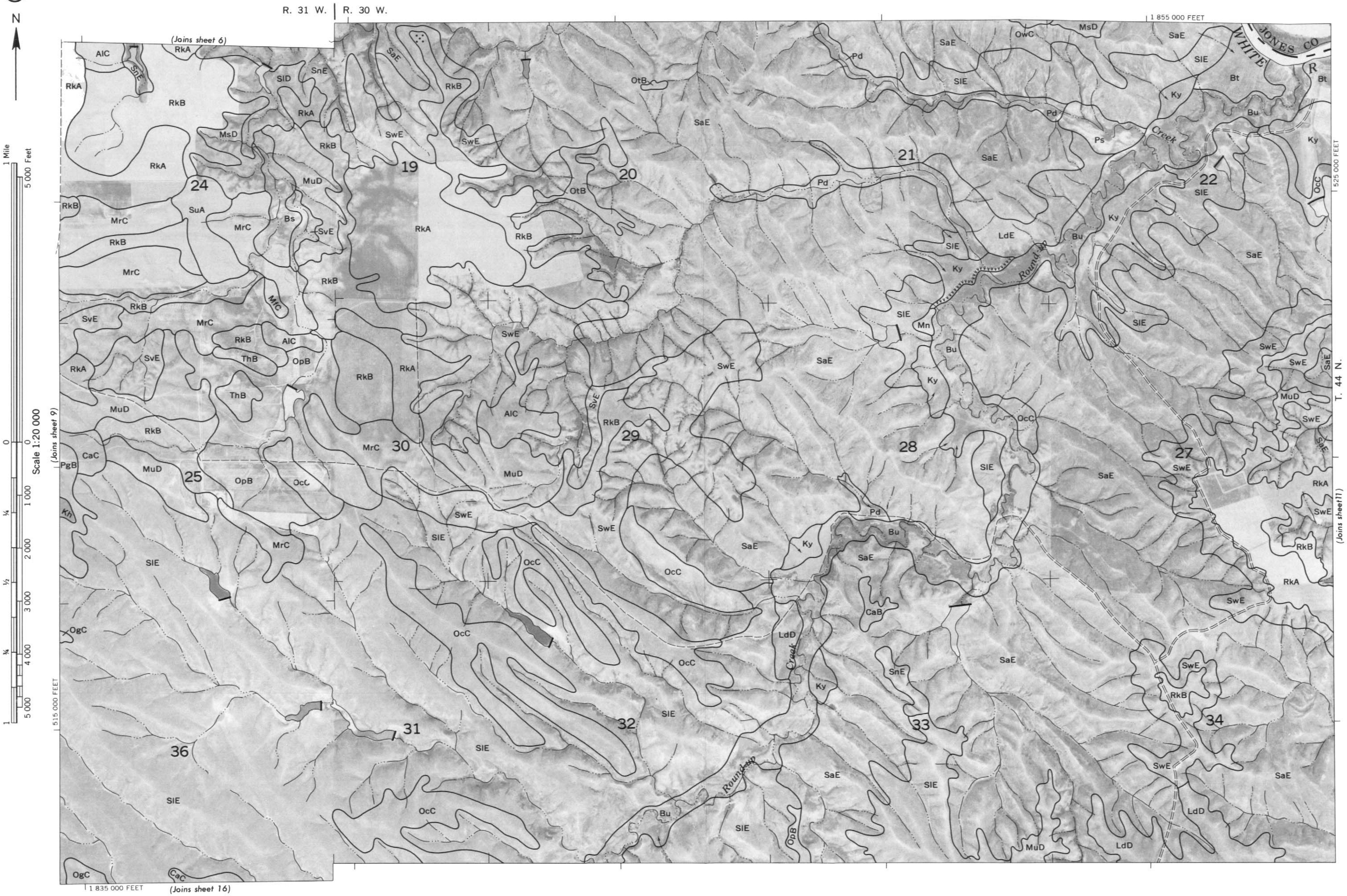
(Joins sheet 15)

1 Mile

5 000 Feet

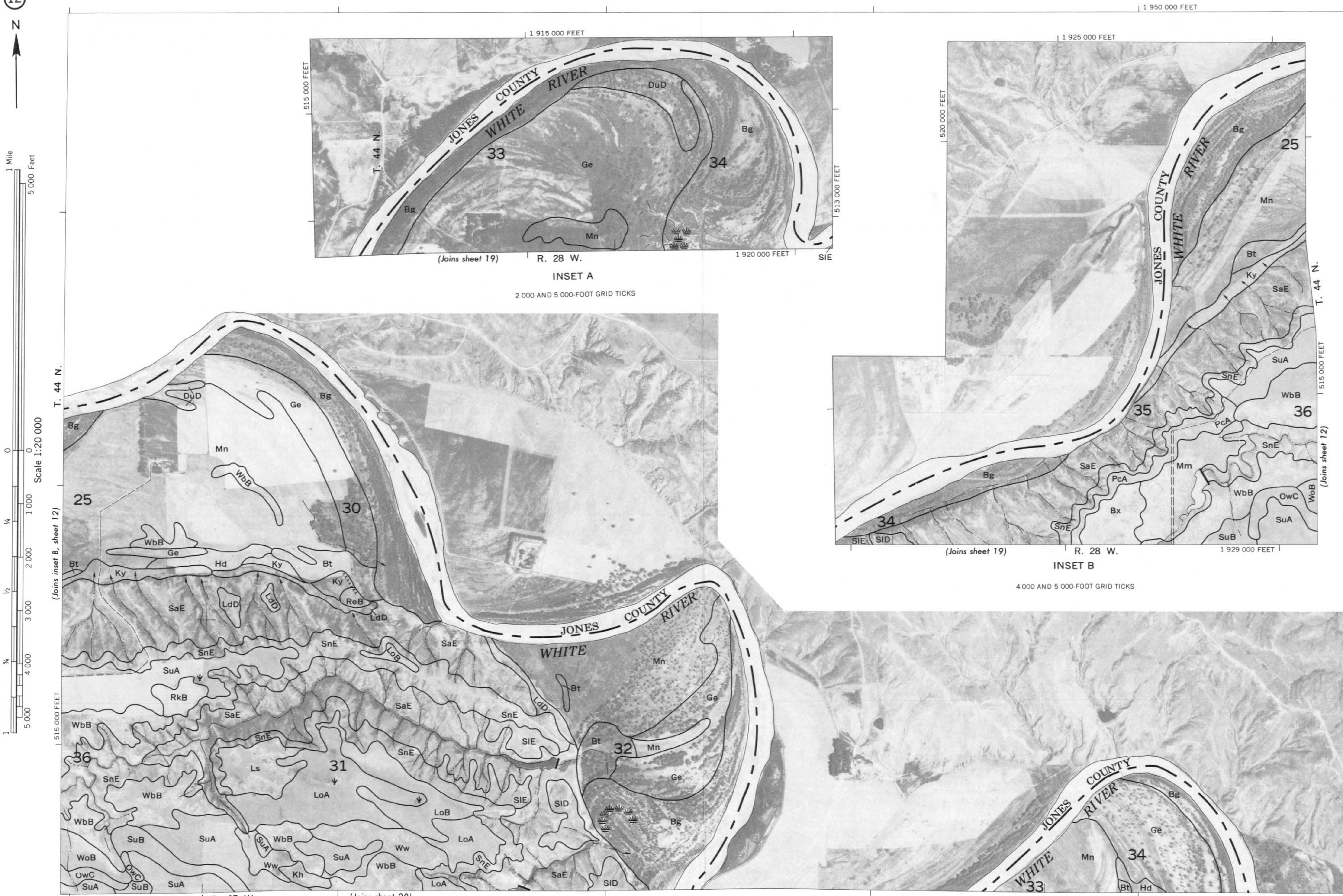
Scale 1:20 000

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 10



(11)


1 860 000 FEET
(Joins inset, sheet 6)
525 000 FEET
T. 44 N.
(Joins sheet 10)
WHITE R
JONES COUNTY
WHITE RIVER
Old Channel
Creek
Butch
JONES COUNTY
WHITE
RIVER
WHITE
JONES
COUNTY
RIVER
23
24
25
26
19
30
29
35
36
31
32
Ge
Bt
Mn
Hd
Ky
OcC
SaE
MuD
SwE
RkA
Bg
LoB
LoA
Ls
ReB
SnE
SlE
Bu
Mm
Bx
WbB
R. 30 W. | R. 29 W.
(Joins sheet 17)
1 880 000 FEET
515 000 FEET
N
1 Mile
5 000 Feet
Scale 1:20 000
0
¼
½
¾
1
1 000
2 000
3 000
4 000
5 000


N
1 Mile
5 000 Feet
Scale 1:20 000
1 915 000 FEET
1 925 000 FEET
1 950 000 FEET
515 000 FEET
513 000 FEET
520 000 FEET
525 000 FEET
1 920 000 FEET
1 929 000 FEET
1 930 000 FEET
T. 44 N.
R. 28 W.
R. 28 W. | R. 27 W.
JONES COUNTY
WHITE RIVER
(Joins sheet 19)
INSET A
2 000 AND 5 000-FOOT GRID TICKS
INSET B
4 000 AND 5 000-FOOT GRID TICKS
(Joins inset B, sheet 12)
(Joins sheet 12)
(Joins sheet 20)

R. 33 W. | R. 32 W.

1 765 000 FEET

(Joins sheet 7)

510 000 FEET

T. 43 N.

COUNTY

WASHABAUGH

Porcupine Creek

Black Pipe Creek

(Joins sheet 14)

(Joins sheet 24)

1 785 000 FEET

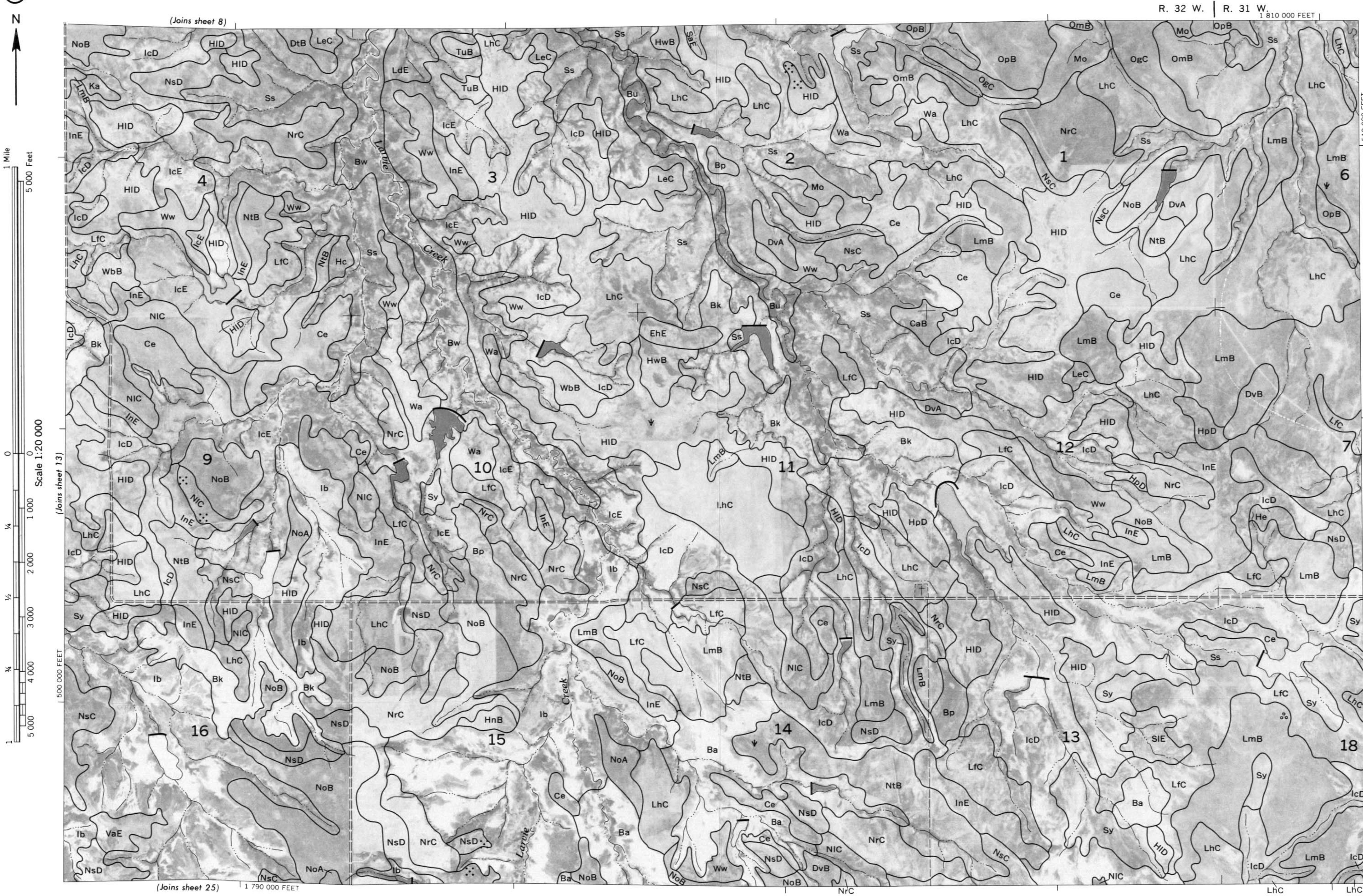
500 000 FEET

N

1 Mile

5 000 Feet

Scale 1:20 000


N
R. 32 W.
R. 31 W.
1 810 000 FEET
510 000 FEET
500 000 FEET
1 790 000 FEET
T. 43 N.
(Joins sheet 8)
(Joins sheet 13)
(Joins sheet 15)
(Joins sheet 25)
Scale 1:20 000
1 Mile
5 000 Feet
Laramie Creek
Creek
Laramie
1
2
3
4
6
7
9
10
11
12
13
14
15
16
18

15

N

1 815 000 FEET

R. 31 W.

(Joins sheet 9)

510 000 FEET

T. 43 N.

(Joins sheet 14)

(Joins sheet 16)

500 000 FEET

1 830 000 FEET

(Joins sheet 26)

1 Mile 0 5 000 Feet

Scale 1:20 000

1/4 1/2 3/4 1

0 1 000 2 000 3 000 4 000 5 000

R. 31 W. | R. 30 W.

(Joins sheet 10)

1 855 000 FEET

510 000 FEET

T. 43 N.

(Joins sheet 17)

(Joins sheet 15)

500 000 FEET

1 835 000 FEET

(Joins sheet 27)

N

1 Mile 5 000 Feet

Scale 1:20 000

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000

Creek

Round-up

Butch

1 2 3 4 5 6 7 8 9 10 11 12 13 15 16 17 18

(Joins sheet 11)

1 860 000 FEET

R. 30 W. | R. 29 W.

510 000 FEET

T. 43 N.

(Joins sheet 16)

(Joins sheet 18)

500 000 FEET

(Joins sheet 28)

1 880 000 FEET

N

1 Mile

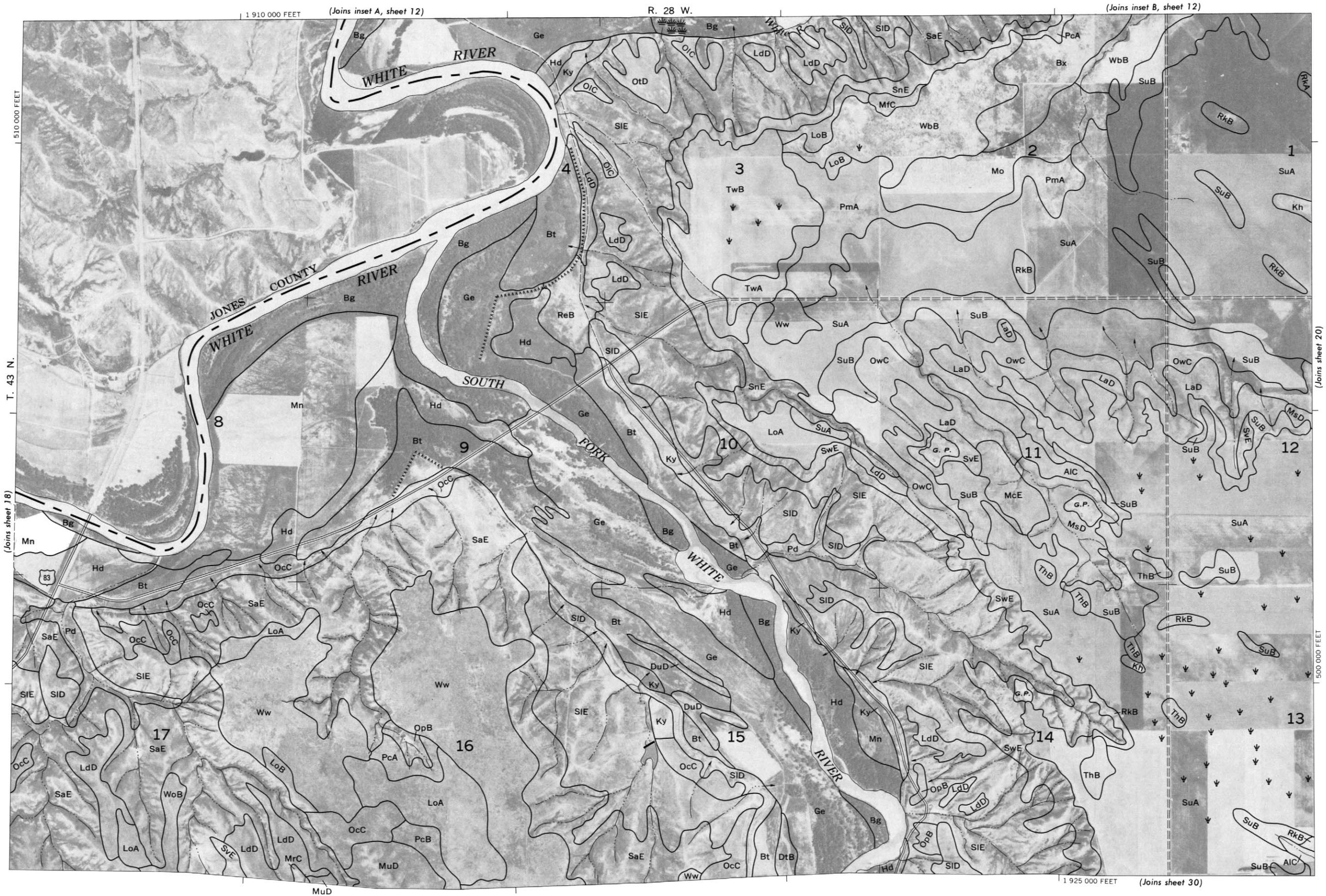
5 000 Feet

Scale 1:20 000

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000


18
N
1 Mile
5 000 Feet
Scale 1:20 000
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1
(Joins sheet 17)
(Joins sheet 19)
(Joins sheet 29)
1 905 000 FEET
510 000 FEET
500 000 FEET
1 885 000 FEET
T. 43 N.
R. 29 W.
R. 28 W.
JONES COUNTY
WHITE R
WHITE RIVER
Cottonwood Creek
83
2
3
4
7
9
10
11
12
13
14
15
16
18


1 910 000 FEET
(Joins inset A, sheet 12)
R. 28 W.
(Joins inset B, sheet 12)
510 000 FEET
T. 43 N.
WHITE RIVER
JONES COUNTY
WHITE RIVER
SOUTH FORK
WHITE RIVER
WHITE R.
(Joins sheet 18)
(Joins sheet 20)
(Joins sheet 30)
1 925 000 FEET
500 000 FEET
MuD
N
1 Mile
5 000 Feet
Scale 1:20 000

20

N

R. 28 W. | R. 27 W.

(Joins sheet 12)

1 950 000 FEET

510 000 FEET

T. 43 N.

JONES COUNTY

WHITE RIVER

Creek

Kaiser Creek

GRAVEL PIT

1 Mile

5 000 Feet

Scale 1:20 000

(Joins sheet 19)

(Joins sheet 21)

500 000 FEET

1 930 000 FEET

(Joins sheet 31)


1 955 000 FEET
510 000 FEET
500 000 FEET
1 975 000 FEET
WHITE RIVER
JONES COUNTY
WHITE RIVER
JONES COUNTY
Thunder Creek
White
T. 43 N.
(Joins sheet 20)
(Joins sheet 22)
(Joins sheet 32)
R. 27 W.
R. 26 W.
N
Scale 1:20 000
1 Mile
5 000 Feet
0
1/4
1/2
3/4
1
1 000
2 000
3 000
4 000
5 000
Ge
Bg
Mn
LdD
SaE
Hd
Bt
SlD
SlE
Bu
LoB
LoA
Ls
WbB
SnE
Kh
Ky
OcC
RkB
RkA
WoB
MsD
SuB
LdD
Pd
Ps
AlC
OwC
MuD
MrC
SwE
Mm
Bx
1
2
5
6
7
8
9
11
12
13
14
16
17
18


N
Scale 1:20 000
1 Mile
5 000 Feet
0
¼
½
¾
1
1 000
2 000
3 000
4 000
5 000
2 000 000 FEET
510 000 FEET
500 000 FEET
1 980 000 FEET
T. 43 N.
R. 26 W.
R. 25 W.
(Joins sheet 21)
(Joins sheet 23)
(Joins sheet 33)
WHITE RIVER
WHITE RIVER
JONES COUNTY
JONES COUNTY
LYMAN CO
Louis Creek
1
2
3
4
6
7
9
10
11
12
13
14
15
16
18
Bg
Mn
Ge
Bt
Ky
SaE
SnE
Pd
SlE
Hd
DsC
LoA
LoB
Kh
Ls
WbB
SuA
SuB
SuC
SlD
OcC
OwC
MuD
Bu
RkA
RkB
LaD
AlC
WoB
MsD
MrC
SvE
MuD
Mm
Ps
OmB
SwE
LdD

N

2 005 000 FEET

510 000 FEET

T. 43 N.

(Joins sheet 22)

LYMAN COUNTY

WHITE RIVER

8 9 16 17

Mn Bt Bx Mm Ky OmB Bu SaE LoA SwE Ls LoB SnE WbB Kh RkA SuA RkB SaE Ge OcC

53

R. 25 W.

2 026 000 FEET

503 000 FEET

12

Ha DtB Hd Ky Ge

SIE 13

(Joins sheet 23)

497 000 FEET

TRIPP COUNTY

Bt

SIE Ky

2 025 000 FEET

(Joins sheet 35)

1 000 AND 3 000 -FOOT GRID TICKS

(Joins inset, sheet 23)

500 000 FEET

Bg Hd 14 Mn Bt Ky Mm SaE SIE 13 SnE LoA WbB Ls

15

2 020 000 FEET

(Joins sheet 34)

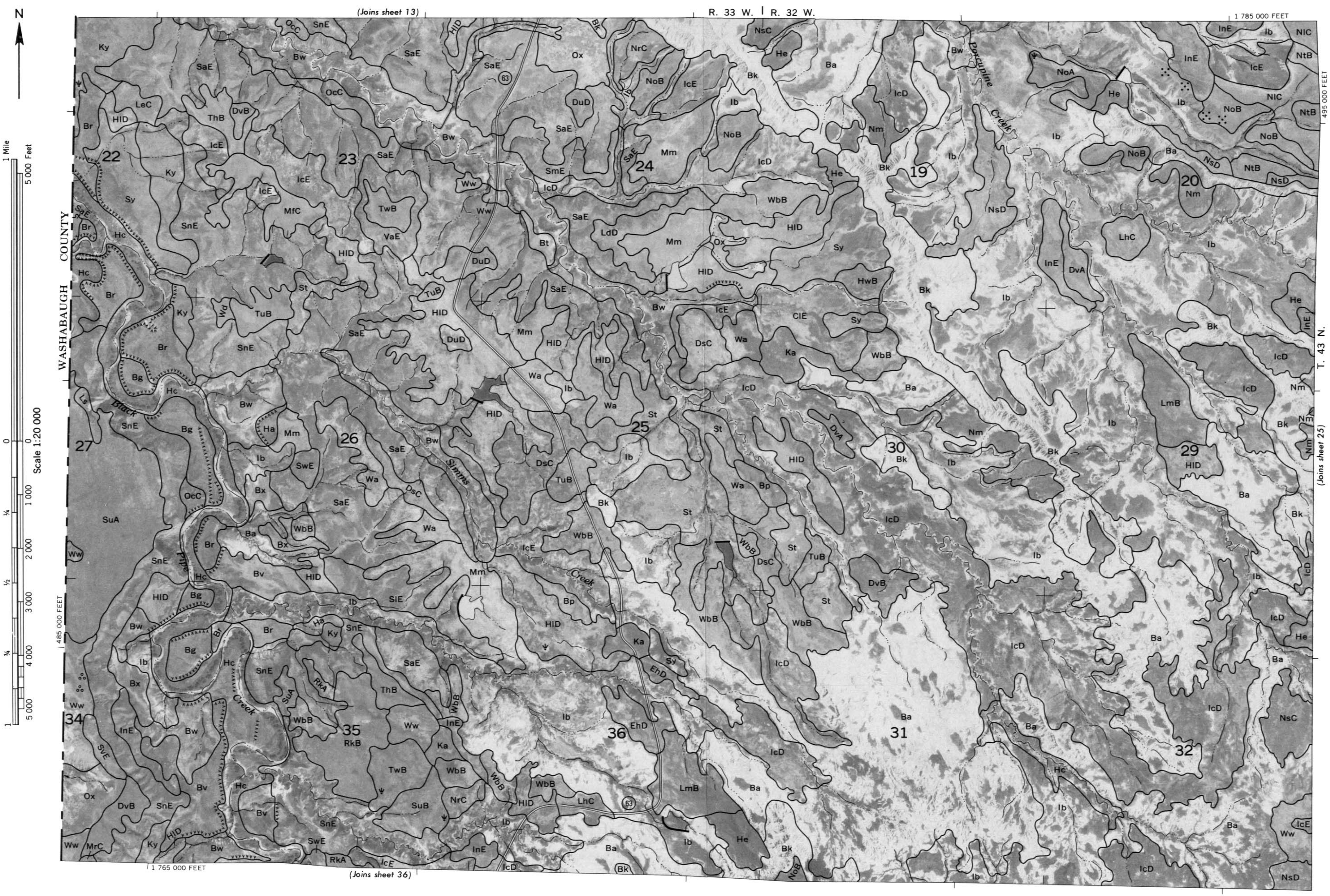
1 Mile

5 000 Feet

Scale 1:20 000

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000


N
1 Mile
5 000 Feet
Scale 1:20 000
(Joins sheet 13)
R. 33 W.
R. 32 W.
1 785 000 FEET
495 000 FEET
T. 43 N.
(Joins sheet 25)
WASHABAUGH COUNTY
485 000 FEET
1 765 000 FEET
(Joins sheet 36)
Porcupine Creek
Black Pipe Creek
Simmons Creek
63
22
23
24
19
20
27
26
25
30
29
34
35
36
31
32

1 790 000 FEET

(Joins sheet 14) R. 32 W. | R. 31 W.

495 000 FEET

T. 43 N.

(Joins sheet 24)

(Joins sheet 26)

485 000 FEET

(Joins sheet 37)

1 810 000 FEET

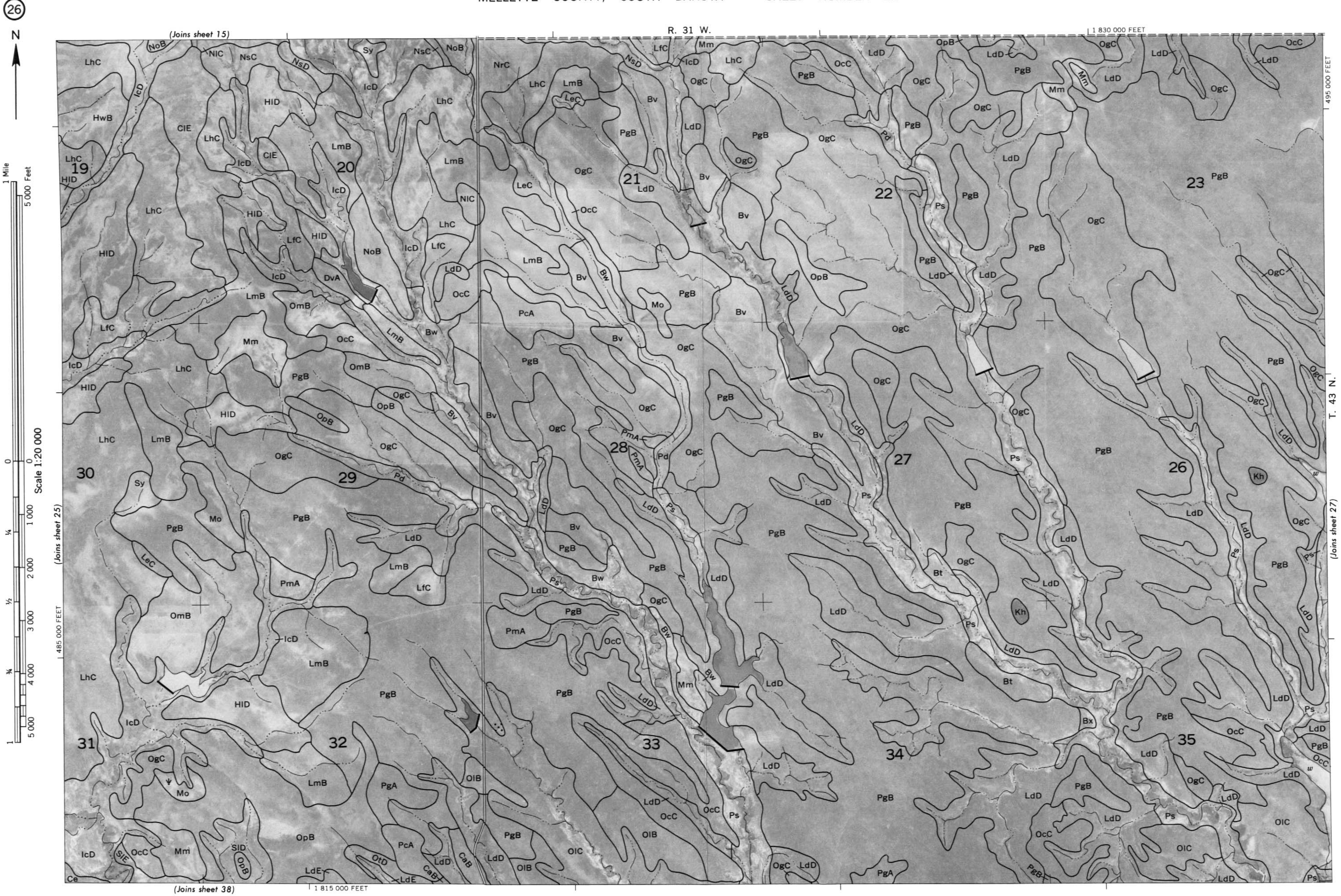
N

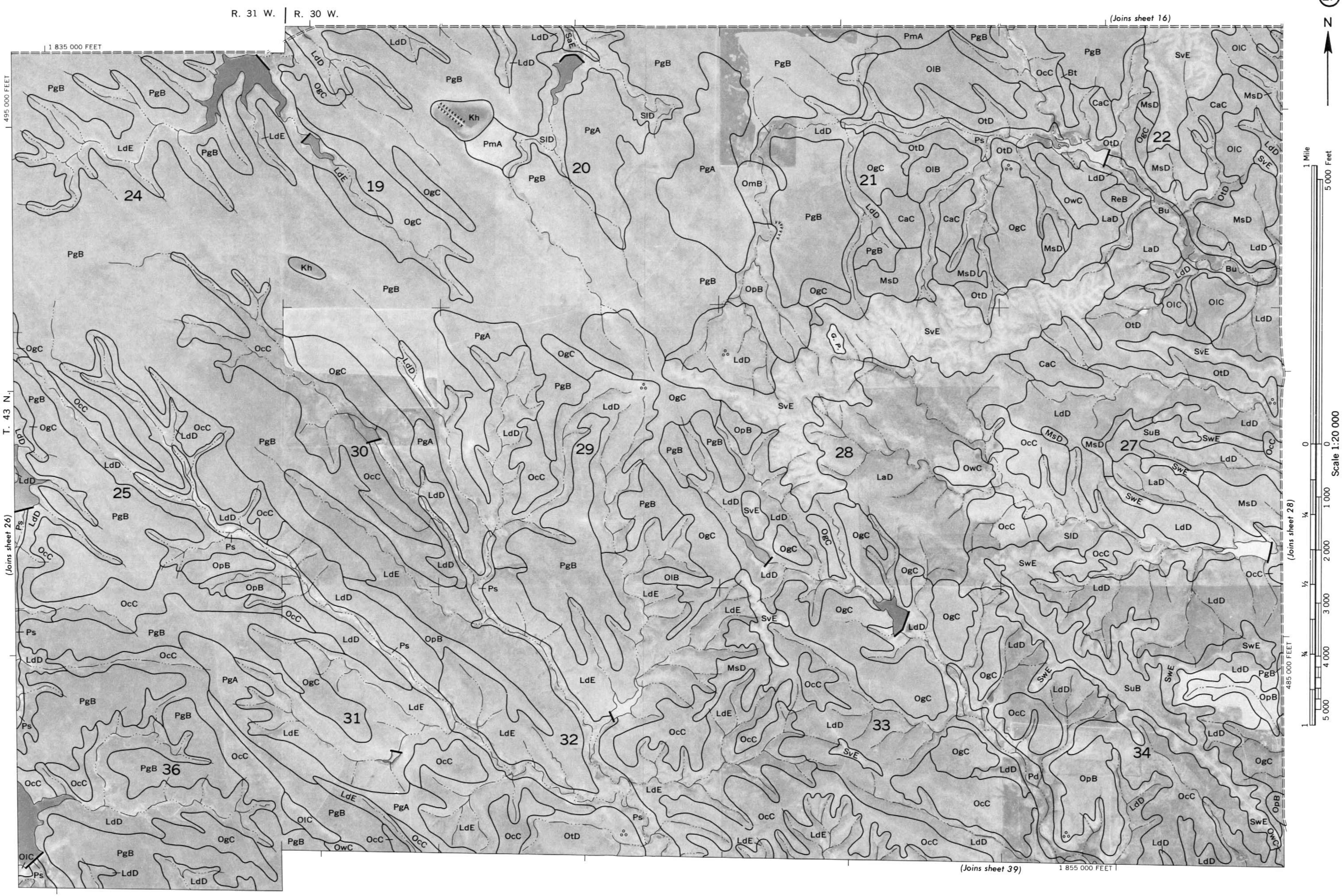
Scale 1:20 000

1 Mile

5 000 Feet

0 0 ¼ 1 000 ½ 2 000 ¾ 3 000 1 4 000 5 000


26
N
(Joins sheet 15)
R. 31 W.
1 830 000 FEET
495 000 FEET
T. 43 N.
(Joins sheet 27)
(Joins sheet 25)
485 000 FEET
(Joins sheet 38)
1 815 000 FEET
1 Mile
5 000 Feet
Scale 1:20 000
19
20
21
22
23
30
29
28
27
26
31
32
33
34
35


27
N
R. 31 W.
R. 30 W.
(Joins sheet 16)
1 835 000 FEET
495 000 FEET
T. 43 N.
(Joins sheet 26)
(Joins sheet 28)
(Joins sheet 39)
1 855 000 FEET
485 000 FEET
19
20
21
22
24
25
27
28
29
30
31
32
33
34
36
1 Mile
5 000 Feet
Scale 1:20 000

N

(Joins sheet 17)

R. 30 W. | R. 29 W.

1 880 000 FEET

495 000 FEET

T. 43 N.

1 Mile

5 000 Feet

0

Scale 1:20 000

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000

485 000 FEET

(Joins sheet 27)

1 860 000 FEET

(Joins sheet 40)

(Joins sheet 29)

23 24 19 20 21

26 25 30 29 28

35 36 31 32 33

Creek

Cottonwood

Cottonwood School

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 29

29

N

R. 29 W. | R. 28 W.

(Joins sheet 18)

1 885 000 FEET

495 000 FEET

T. 43 N.

(Joins sheet 28)

(Joins sheet 30)

(Joins sheet 41)

1 905 000 FEET

485 000 FEET

Cottonwood Creek

GRAVEL PIT

1 Mile

5 000 Feet

Scale 1:20 000

1 0 0 5 000

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

30

N

(Joins sheet 19)

R. 28 W.

1 925 000 FEET

495 000 FEET

T. 43 N.

(Joins sheet 31)

(Joins sheet 29)

485 000 FEET

(Joins sheet 42)

1 910 000 FEET

1 Mile

5 000 Feet

Scale 1:20 000

0 0 ¼ 1 000 ½ 2 000 ¾ 3 000 1 4 000 5 000

WHITE RIVER

SOUTH FORK

20 21 22 23 24 25 26 27 28 29 32 33 34 35 36

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 31

1 930 000 FEET

R. 28 W. | R. 27 W.

(Joins sheet 20)

1 495 000 FEET

T. 43 N.

(Joins sheet 30)

(Joins sheet 32)

(Joins sheet 43)

1 485 000 FEET

1 950 000 FEET

N

1 Mile

5 000 Feet

Scale 1:20 000

GRAVEL PIT

Creek

32

N

R. 27 W. | R. 26 W.

T. 43 N.

1 975 000 FEET

495 000 FEET

485 000 FEET

1 955 000 FEET

(Joins sheet 21)

(Joins sheet 31)

(Joins sheet 33)

(Joins sheet 44)

Scale 1:20 000

1 Mile 5 000 Feet

0 0 ¼ 1 000 ½ 2 000 ¾ 3 000 1 4 000 1¼ 5 000

Creek

Thunder

White

Creek

Thunder

White

23 24 19 20 21 26 25 30 29 28 35 36 31 32 33

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 33

33

N

1 980 000 FEET

R. 26 W. | R. 25 W.

(Joins sheet 22)

495 000 FEET

T. 43 N.

(Joins sheet 32)

(Joins sheet 34)

485 000 FEET

(Joins sheet 45)

2 000 000 FEET

1 Mile

5 000 Feet

Scale 1:20 000

0 0 ¼ 1 000 ½ 2 000 ¾ 3 000 ¾ 4 000 1 5 000

N

1 Mile

5 000 Feet

Scale 1:20 000

0 0 1 000 ¼ 2 000 ½ 3 000 ¾ 4 000 1 5 000

(Joins sheet 23)

R. 25 W.

2 020 000 FEET

495 000 FEET

T. 43 N.

(Joins sheet 35)

485 000 FEET

(Joins sheet 33)

(Joins sheet 46)

2 005 000 FEET

20 21 22 23 24 25 26 27 28 29 32 33 34 35 36

G.P. GRAVEL PIT

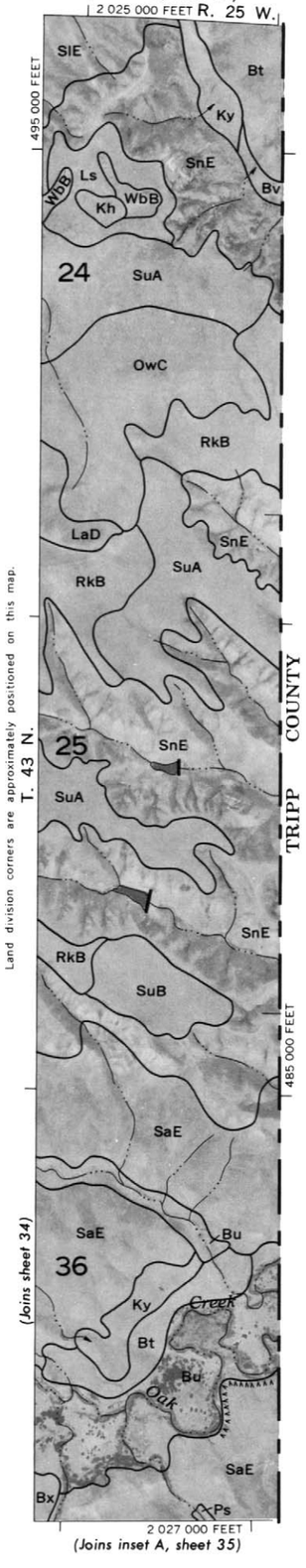
ROSEBUD CEMETERY

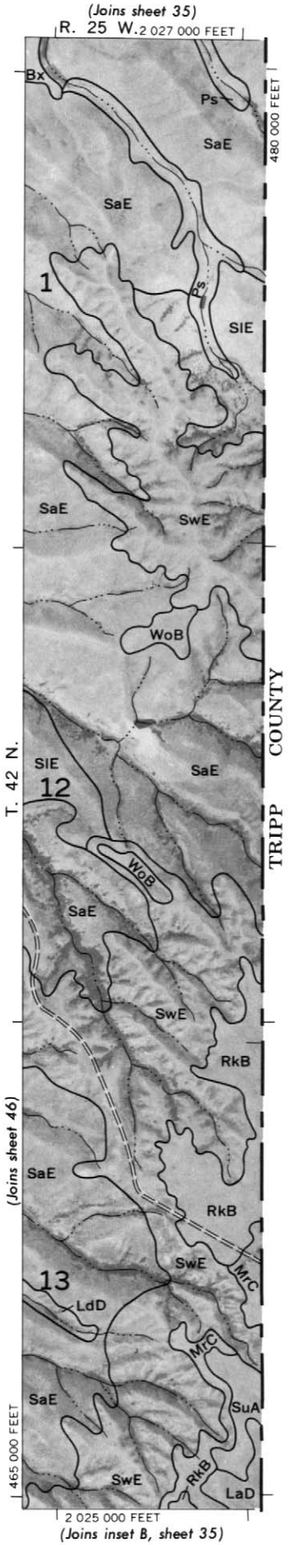
Louis Creek

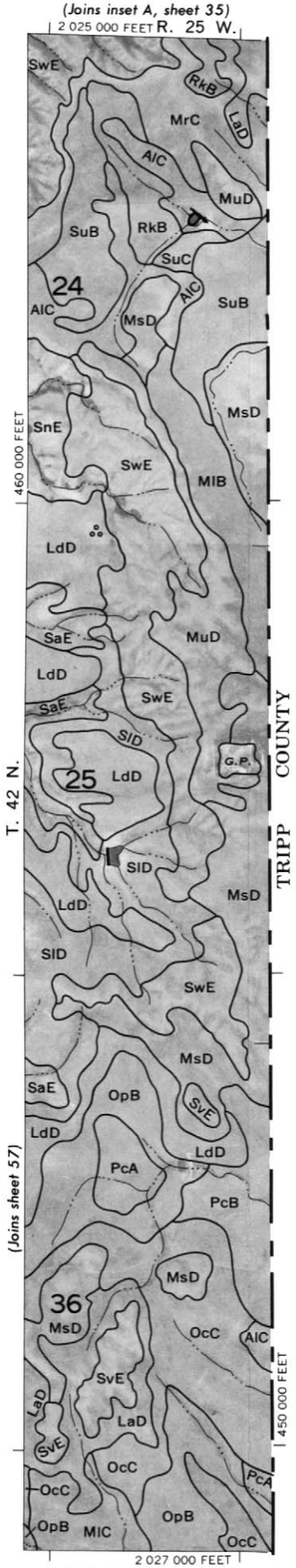
Oak Creek

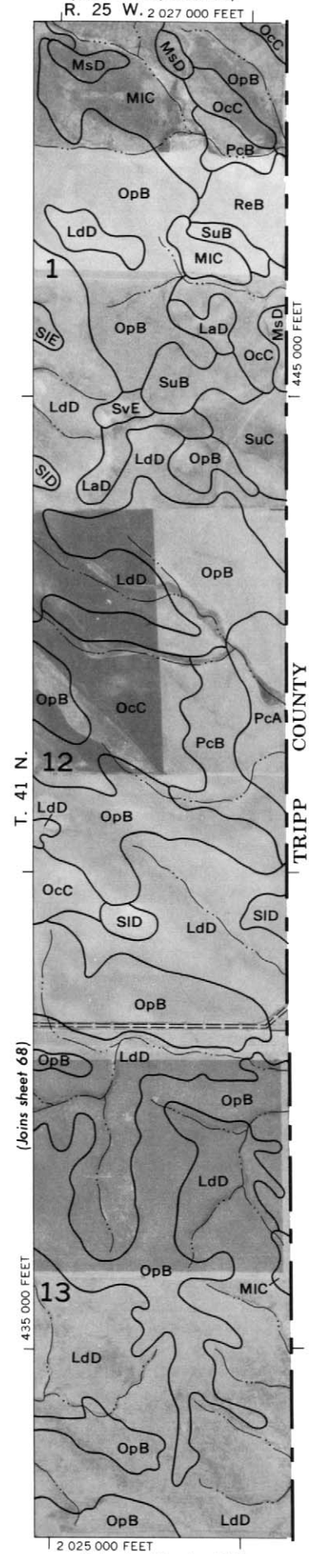
N

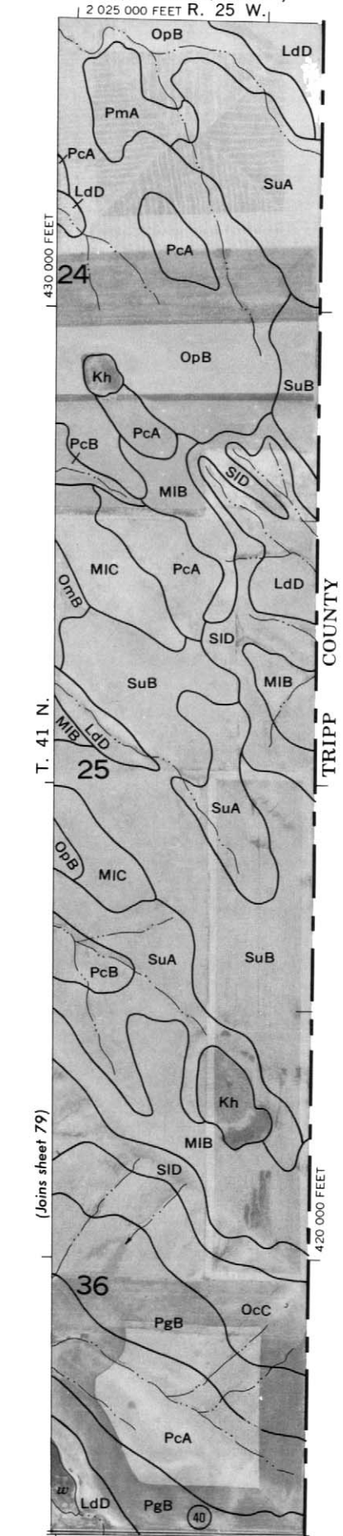
Land division corners are approximately positioned on this map.





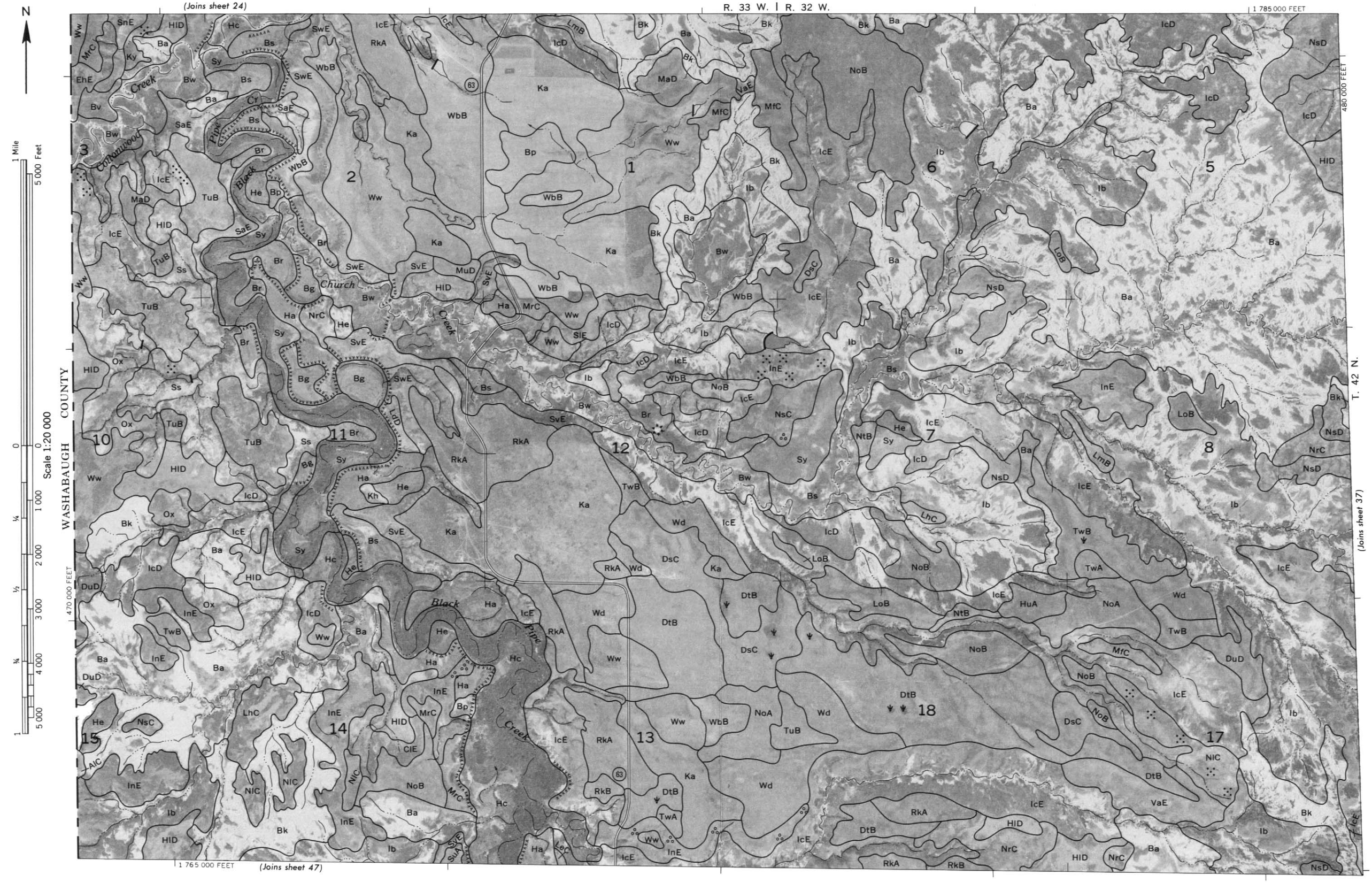






1 Mile
5 000 Feet
0
Scale 1:20 000
¼
2 000
1 000
½
3 000
¾
4 000
1
5 000

2 000 AND 5 000 FOOT GRID TICKS FOR SHEET 35 AND INSETS A, B, C, AND D.


N
1 Mile
5 000 Feet
Scale 1:20 000
0
¼
½
¾
1
1 000
2 000
3 000
4 000
5 000
WASHABAUGH COUNTY
(Joins sheet 24)
R. 33 W.
R. 32 W.
1 785 000 FEET
480 000 FEET
470 000 FEET
1 765 000 FEET
(Joins sheet 47)
T. 42 N.
(Joins sheet 37)
Creek
Cr
Church
Black Pipe
Black Pipe Creek
Cottonwood
63
1
2
3
5
6
7
8
10
11
12
13
14
15
17
18

N

1 790 000 FEET

480 000 FEET

(Joins sheet 25)

R. 32 W. | R. 31 W.

T. 42 N.

(Joins sheet 36)

(Joins sheet 38)

(Joins sheet 48)

1 810 000 FEET

1 465 000 FEET

Cottonwood Creek

1 Mile

5 000 Feet

Scale 1:20 000

N

(Joins sheet 26)

R. 31 W.

1 830 000 FEET

480 000 FEET

T. 42 N.

(Joins sheet 39)

(Joins sheet 37)

1 Mile

5 000 Feet

Scale 1:20 000

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000

Cottonwood Creek

Cottonwood Creek

6 5 4 3 2 1

7 8 9 10 11 12

18 17 16 15 14 13

465 000 FEET

(Joins sheet 49)

1 815 000 FEET

R. 31 W. | R. 30 W.

N

1 835 000 FEET

480 000 FEET

T. 42 N.

(Joins sheet 27)

(Joins sheet 40)

(Joins sheet 38)

(Joins sheet 50)

1 855 000 FEET

470 000 FEET

1 Mile

5 000 Feet

Scale 1:20 000

Cottonwood Creek

Cottonwood Creek

(40)

N

(Joins sheet 28)

R. 30 W. | R. 29 W.

1 880 000 FEET

480 000 FEET

T. 42 N.

1 Mile

5 000 Feet

Scale 1:20 000

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000

1 470 000 FEET

(Joins sheet 39)

(Joins sheet 41)

1 860 000 FEET

(Joins sheet 51)

Cottonwood Creek

GRAVEL PIT

G. P.

2 1 6 5 4

11 12 7 8 9

14 13 18 17 16

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 41

41

R. 29 W. | R. 28 W.

(Joins sheet 29)

1 885 000 FEET

480 000 FEET

T. 42 N.

N

1 Mile

5 000 Feet

Scale 1:20 000

(Joins sheet 40)

(Joins sheet 42)

(Joins sheet 52)

1 905 000 FEET

465 000 FEET

WHITE RIVER

SOUTH BORK

42

N

R. 28 W.

T. 42 N.

1 925 000 FEET

480 000 FEET

1 910 000 FEET

465 000 FEET

(Joins sheet 30)

(Joins sheet 41)

(Joins sheet 43)

(Joins sheet 53)

WHITE RIVER

SOUTH FORK

1 Mile

5 000 Feet

Scale 1:20 000

0 0 ¼ 1 000 ½ 2 000 ¾ 3 000 1 4 000 5 000

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 43

43

N

1 930 000 FEET R. 28 W. | R. 27 W.

(Joins sheet 31)

480 000 FEET

T. 42 N.

(Joins sheet 42)

(Joins sheet 44)

470 000 FEET

(Joins sheet 54)

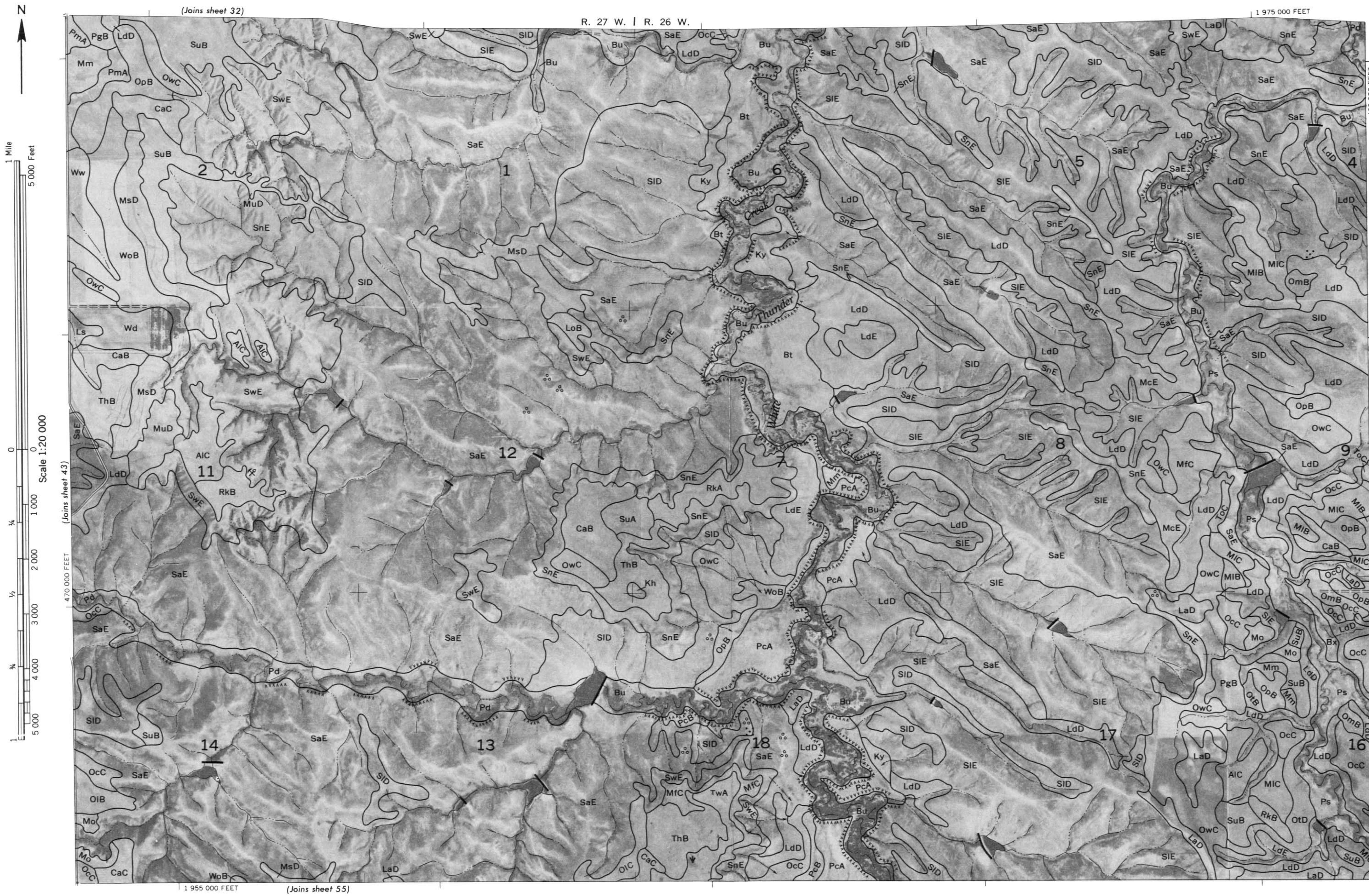
1 950 000 FEET

1 Mile

5 000 Feet

Scale 1:20 000

1 0 1 000 2 000 3 000 4 000 5 000


N
(Joins sheet 32)
R. 27 W.
R. 26 W.
1 975 000 FEET
480 000 FEET
T. 42 N.
(Joins sheet 45)
(Joins sheet 43)
470 000 FEET
1 955 000 FEET
(Joins sheet 55)
Thunder
Creek
White
1 Mile
5 000 Feet
Scale 1:20 000
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 45

45

N

R. 26 W. | R. 25 W.

(Joins sheet 33)

1 980 000 FEET

480 000 FEET

T. 42 N.

(Joins sheet 44)

(Joins sheet 46)

Springview School

Louis Creek

(Joins sheet 56)

2 000 000 FEET

465 000 FEET

1 Mile

5 000 Feet

Scale 1:20 000

(46)

N

R. 25 W.

2 020 000 FEET

480 000 FEET

T. 42 N.

(Joins sheet 34)

(Joins sheet 45)

(Joins inset A, sheet 35)

(Joins sheet 57)

2 005 000 FEET

465 000 FEET

1 Mile 5 000 Feet

Scale 1:20 000

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000

Louis Creek

Oak Creek

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 47

47

N

1 765 000 FEET

R. 33 W. | R. 32 W.

(Joins sheet 36)

465 000 FEET

T. 42 N.

COUNTY

WASHABAUGH

(Joins sheet 48)

(Joins sheet 58)

1 785 000 FEET

450 000 FEET

1 Mile

5 000 Feet

Scale 1:20 000

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000

N

Scale 1:20 000

1 Mile 5 000 Feet

0 0

¼ 1 000

½ 2 000

¾ 3 000

¾ 4 000

1 5 000

(Joins sheet 37)

R. 32 W. | R. 31 W.

1 810 000 FEET

460 000 FEET

T. 42 N.

(Joins sheet 47)

(Joins sheet 49)

450 000 FEET

(Joins sheet 59)

1 790 000 FEET

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 49

1 815 000 FEET

R. 31 W.

(Joins sheet 38)

460 000 FEET

T. 42 N.

Running Bird School

Cedar Butte

(Joins sheet 48)

(Joins sheet 60)

1 830 000 FEET

450 000 FEET

(Joins sheet 50)

N

1 Mile

5 000 Feet

Scale 1:20 000

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 50

R. 30 W. | R. 29 W.

1 860 000 FEET

465 000 FEET

T. 42 N.

(Joins sheet 40)

(Joins sheet 50)

(Joins sheet 52)

(Joins sheet 62)

1 880 000 FEET

450 000 FEET

N

1 Mile

5 000 Feet

Scale 1:20 000

0 0 ¼ 1 000 ½ 2 000 ¾ 4 000 1 5 000

23 24 19 20 21 26 25 30 29 28 35 36 31 32 33

Pine Creek

52

N

1 Mile 5 000 Feet

Scale 1:20 000

(Joins sheet 41)

R. 29 W. | R. 28 W.

1 905 000 FEET

460 000 FEET

T. 42 N.

(Joins sheet 53)

(Joins sheet 51)

450 000 FEET

1 885 000 FEET

(Joins sheet 63)

WHITE RIVER

White River School

SEWAGE LAGOON

SOUTH FORK WHITE RIVER

SOUTH FORK WHITE RIVER

Pine Creek

21 22 23 24 19 28 27 26 25 30 33 34 35 36 31

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 53

53

N

1 910 000 FEET

R. 28 W.

(Joins sheet 42)

460 000 FEET

T. 42 N.

(Joins sheet 52)

(Joins sheet 54)

1 925 000 FEET

(Joins sheet 64)

450 000 FEET

1 Mile

5 000 Feet

Scale 1:20 000

1 000

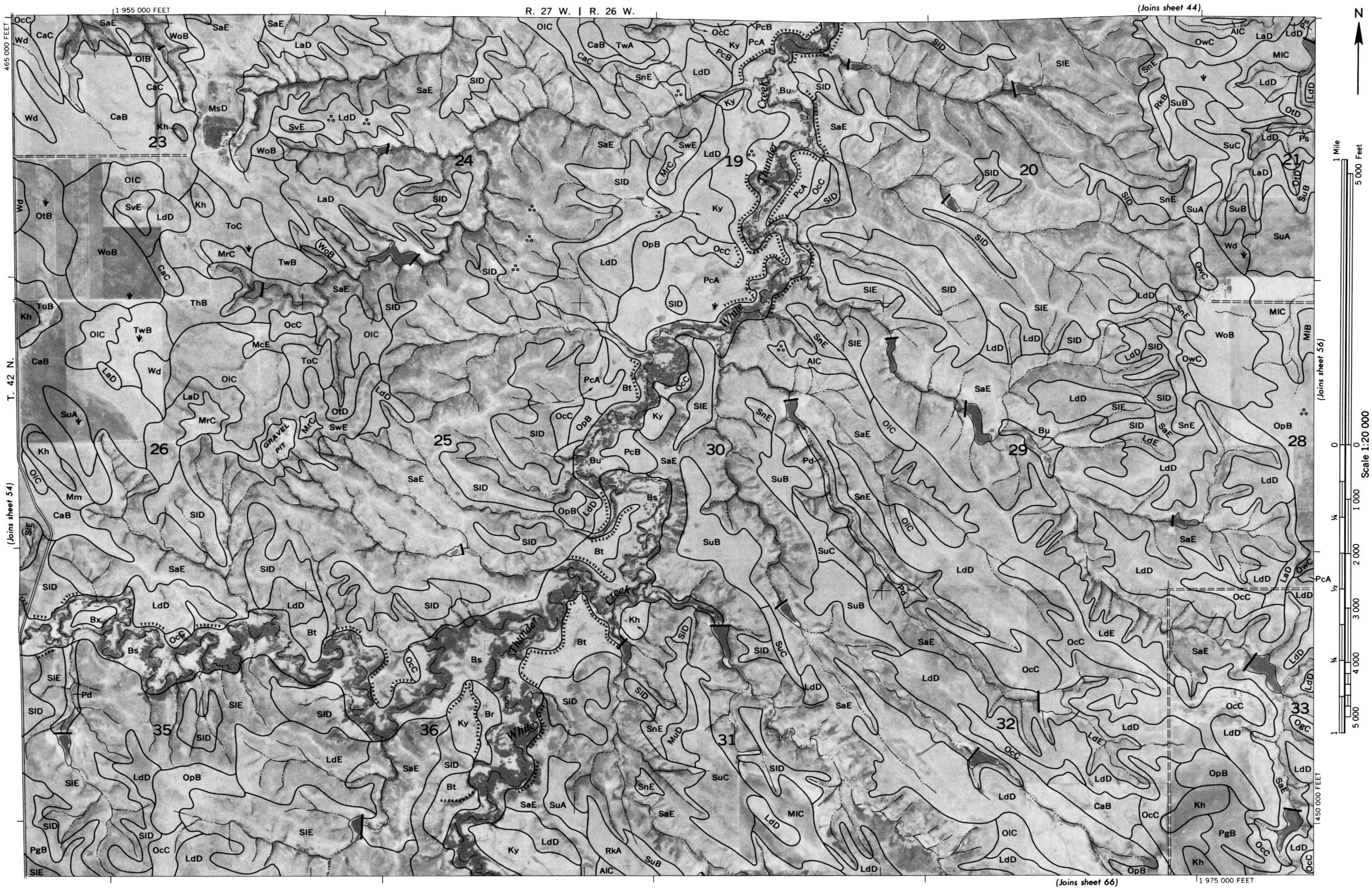
2 000

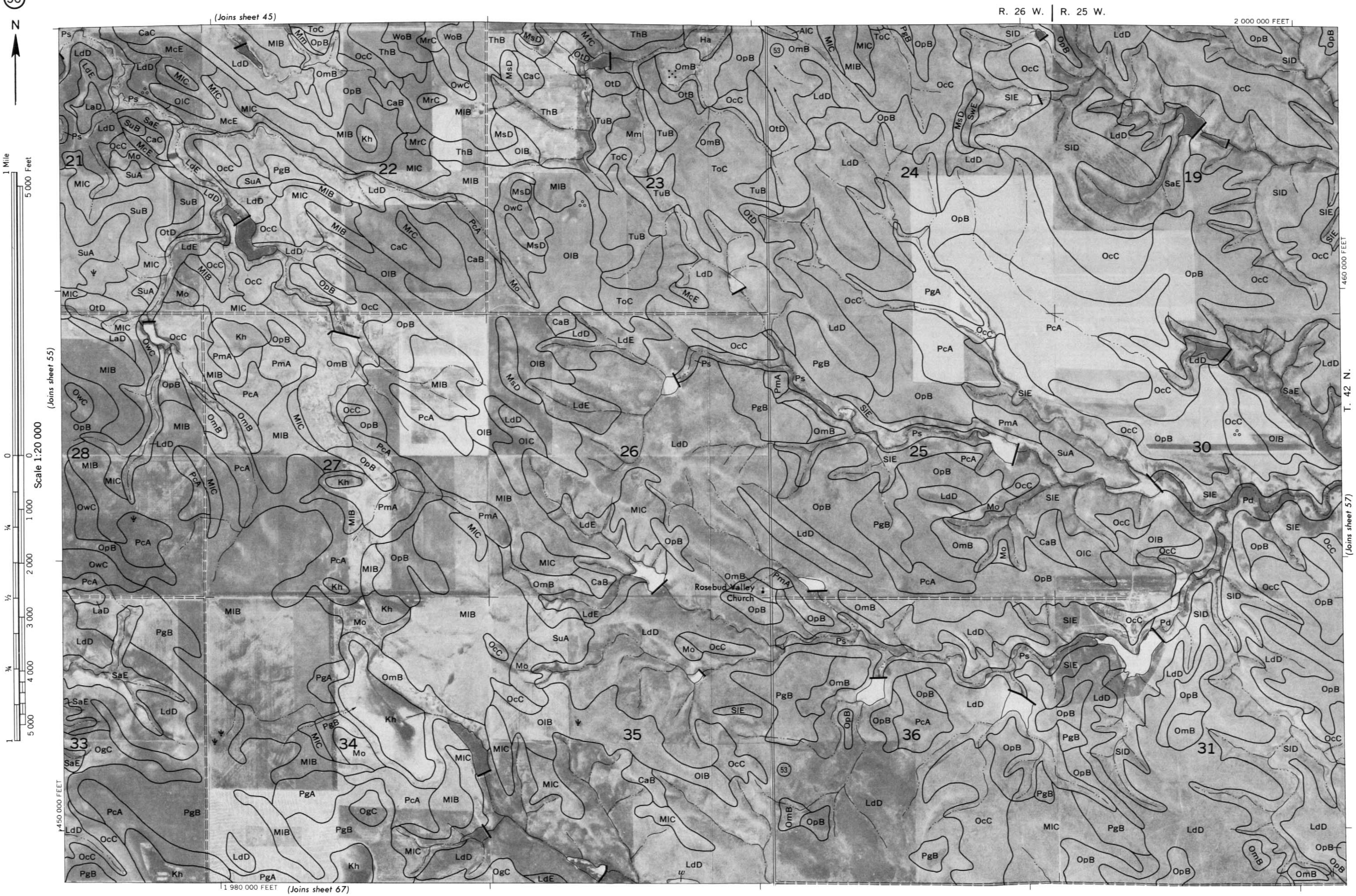
3 000

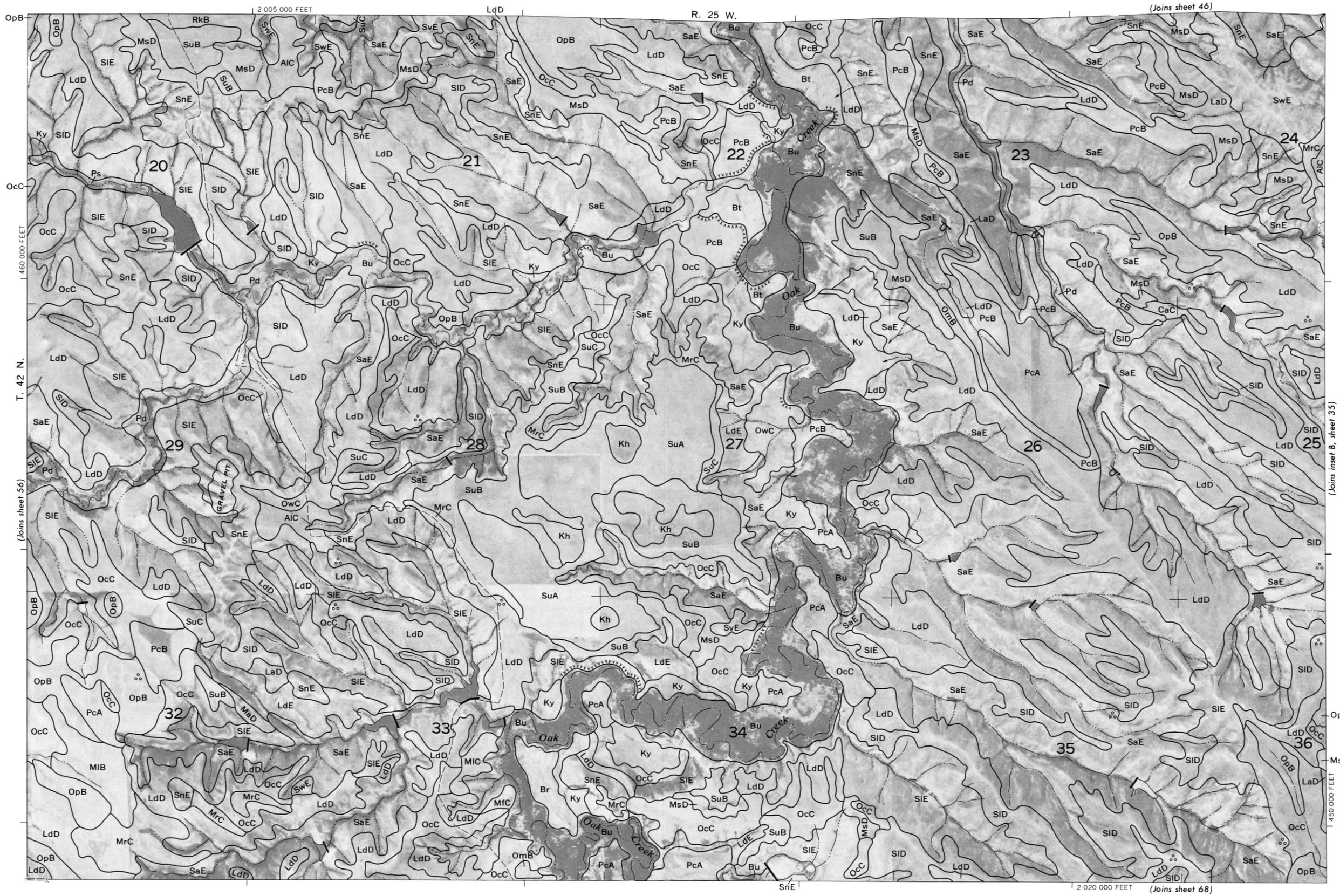
4 000

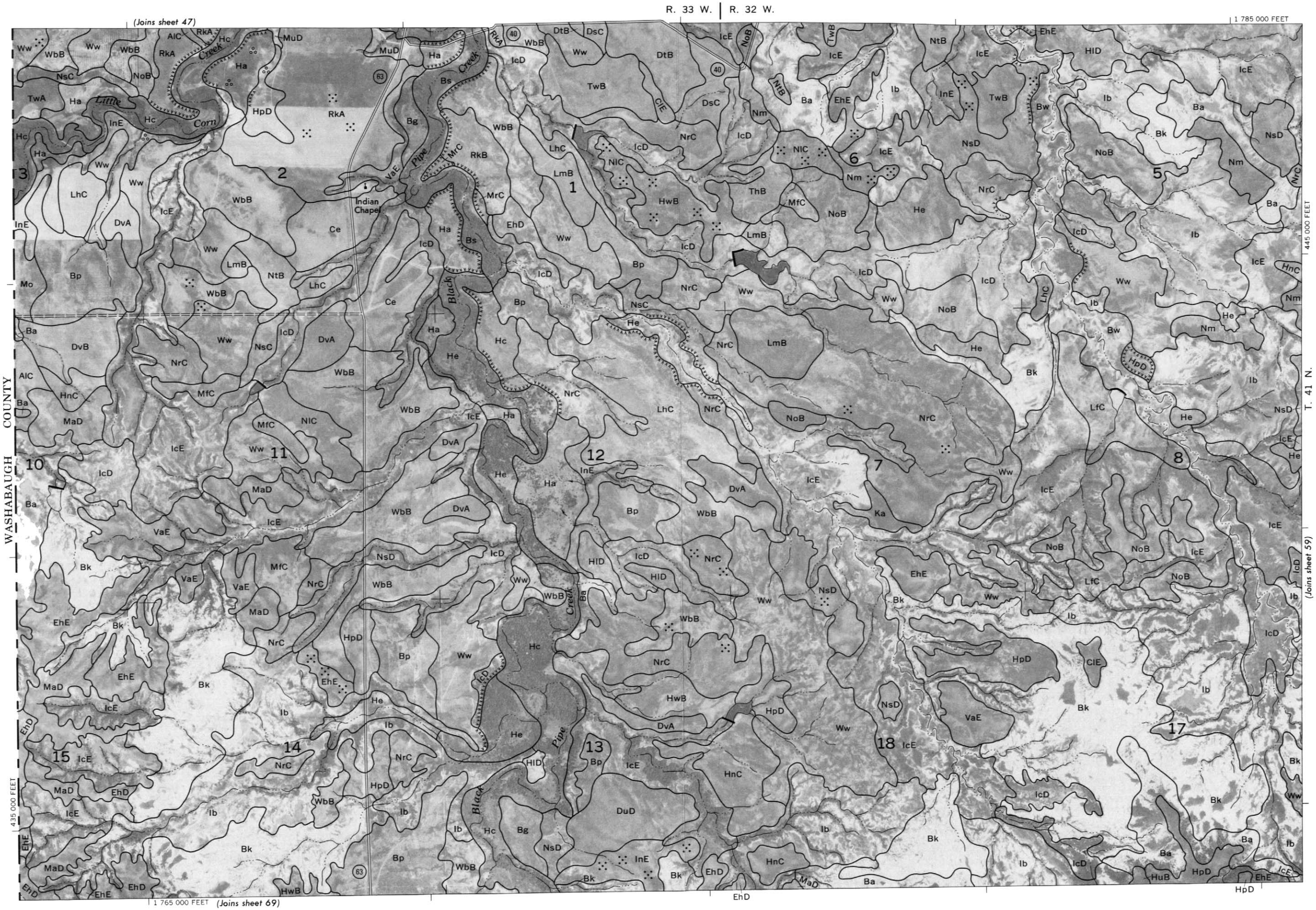
5 000


N
R. 28 W.
R. 27 W.
(Joins sheet 43)
1 950 000 FEET
465 000 FEET
T. 42 N
(Joins sheet 55)
1 Mile
5 000 Feet
Scale 1:20 000
(Joins sheet 53)
450 000 FEET
1 930 000 FEET
(Joins sheet 65)
24
19
20
21
22
25
30
29
28
27
31
32
33
34
36


1 955 000 FEET
R. 27 W. | R. 26 W.
(Joins sheet 44)
N
465 000 FEET
T. 42 N.
(Joins sheet 54)
(Joins sheet 56)
(Joins sheet 66)
1 975 000 FEET
450 000 FEET
1 Mile
5 000 Feet
Scale 1:20 000
White
Thunder
Creek
GRAVEL PIT


56
N
(Joins sheet 45)
R. 26 W. | R. 25 W.
2 000 000 FEET
460 000 FEET
T. 42 N.
(Joins sheet 57)
(Joins sheet 55)
450 000 FEET
1 980 000 FEET
(Joins sheet 67)
1 Mile
5 000 Feet
Scale 1:20 000
0
¼
½
¾
1
0
1 000
2 000
3 000
4 000
5 000
Rosebud Valley Church
21
22
23
24
19
25
26
27
28
30
31
33
34
35
36


2 005 000 FEET
R. 25 W.
(Joins sheet 46)
T. 42 N.
460 000 FEET
450 000 FEET
2 020 000 FEET
(Joins sheet 56)
(Joins inset B, sheet 35)
(Joins sheet 68)
N
1 Mile
5 000 Feet
Scale 1:20 000
Creek
Oak
GRAVEL PIT
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36


R. 33 W.
R. 32 W.
(Joins sheet 47)
1 785 000 FEET
445 000 FEET
T. 41 N.
(Joins sheet 59)
435 000 FEET
1 765 000 FEET
(Joins sheet 69)
WASHABAUGH COUNTY
Little Corn Creek
Indian Chapel
Black Pipe Creek
Scale 1:20 000
1 Mile
5 000 Feet

1 790 000 FEET

(Joins sheet 48) R. 32 W. | R. 31 W.

N

445 000 FEET

T. 41 N.

(Joins sheet 58)

(Joins sheet 60)

1 Mile 5 000 Feet

Scale 1:20 000

0 0 ¼ 1 000 ½ 2 000 ¾ 3 000 1 4 000 5 000

435 000 FEET

(Joins sheet 70)

1 810 000 FEET


N
(Joins sheet 49)
R. 31 W.
1 830 000 FEET
445 000 FEET
T. 41 N.
(Joins sheet 59)
(Joins sheet 61)
(Joins sheet 71)
1 815 000 FEET
435 000 FEET
Scale 1:20 000
1 Mile
5 000 Feet
North Branch Pine Creek
2
3
4
5
6
7
8
9
10
11
14
15
16
17
18

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 61

61

R. 31 W. | R. 30 W.

N

(Joins sheet 50)

1 835 000 FEET

1 445 000 FEET

T. 41 N.

(Joins sheet 60)

(Joins sheet 62)

(Joins sheet 72)

1 855 000 FEET

435 000 FEET

1 Mile

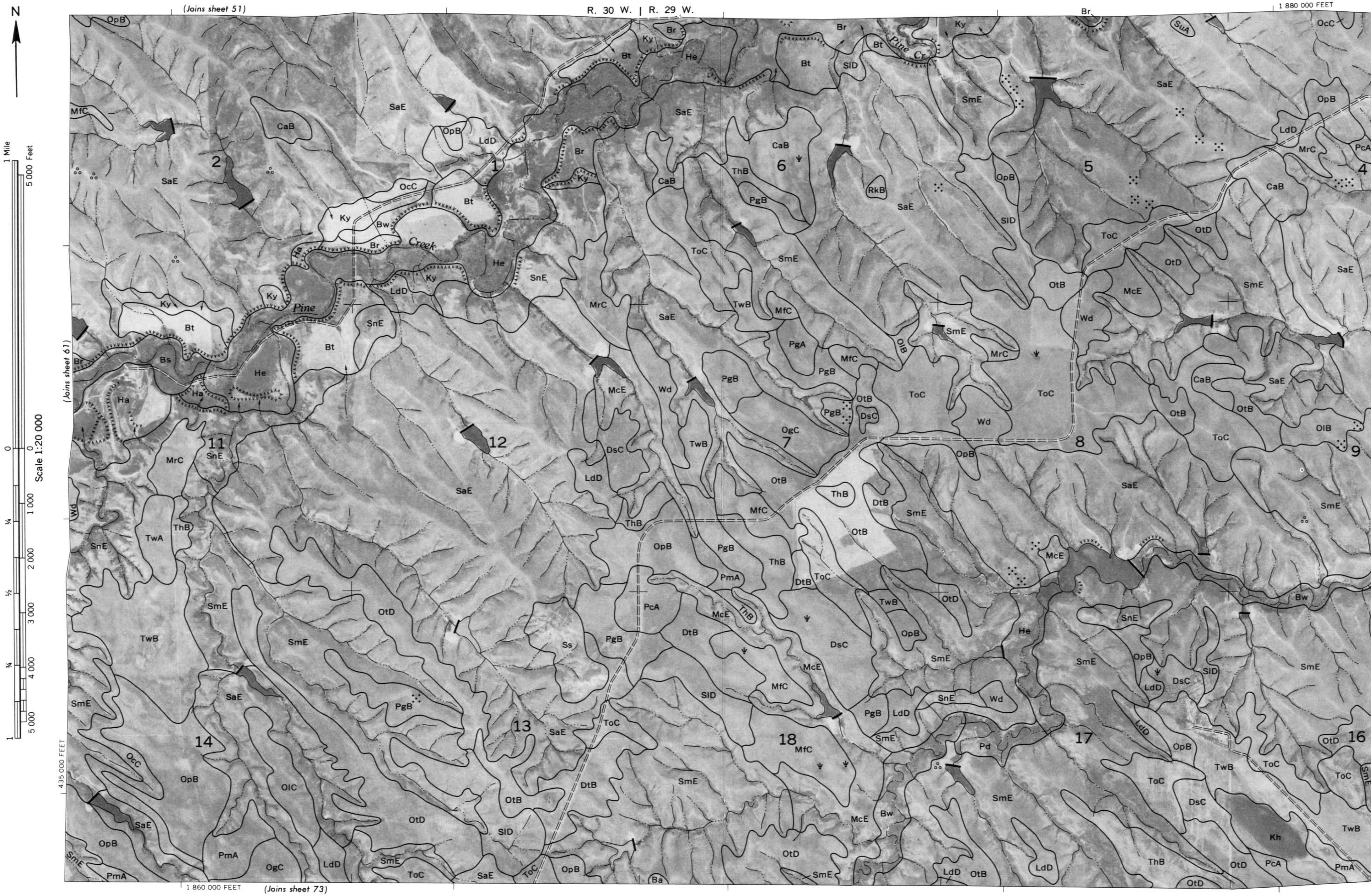
5 000 Feet

Scale 1:20 000

0 1/4 1/2 3/4 1

0 1 000 2 000 3 000 4 000 5 000

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 62



N

R. 29 W. | R. 28 W.

1 885 000 FEET

445 000 FEET

T. 41 N.

(Joins sheet 52)

(Joins sheet 62)

(Joins sheet 64)

(Joins sheet 74)

1 905 000 FEET

435 000 FEET

WHITE RIVER

SOUTH FORK WHITE RIVER

1 Mile

5 000 Feet

Scale 1:20 000

N

R. 28 W.

1 925 000 FEET

(Joins sheet 53)

(Joins sheet 63)

(Joins sheet 65)

(Joins sheet 75)

1 910 000 FEET

T. 41 N.

445 000 FEET

435 000 FEET

1 Mile

5 000 Feet

Scale 1:20 000

0 0 ¼ 1 000 ½ 2 000 ¾ 3 000 1 4 000 5 000

R. 28 W. | R. 27 W.

1 930 000 FEET

(Joins sheet 54)

445 000 FEET

T. 41 N.

(Joins sheet 64)

(Joins sheet 66)

435 000 FEET

(Joins sheet 76)

1 950 000 FEET

N

1 Mile

5 000 Feet

Scale 1:20 000

0 0 1 000 ¼ 2 000 ½ 3 000 ¾ 4 000 1 5 000

N

(Joins sheet 55)

R. 27 W. | R. 26 W.

1 975 000 FEET

445 000 FEET

T. 41 N.

(Joins sheet 65)

435 000 FEET

1 955 000 FEET (Joins sheet 77)

(Joins sheet 67)

Scale 1:20 000

1 Mile 5 000 Feet

0 0 1 000 2 000 3 000 4 000 5 000

Thunder Creek

White

Ha Creek

N

R. 26 W. | R. 25 W.

(Joins sheet 56)

1 980 000 FEET

445 000 FEET

T. 41 N.

(Joins sheet 66)

(Joins sheet 68)

(Joins sheet 78)

435 000 FEET

2 000 000 FEET

1 Mile 5 000 Feet

Scale 1:20 000

0 1 000 2 000 3 000 4 000 5 000

¼ ½ ¾ 1

68

N

1 Mile

5 000 Feet

Scale 1:20 000

(Joins sheet 57)

R. 25 W.

2 020 000 FEET

445 000 FEET

T. 41 N.

(Joins inset C, sheet 3:)

(Joins sheet 67)

435 000 FEET

(Joins sheet 79)

2 005 000 FEET

Oak Creek

Oak Creek

Dreyer School

GRAVEL PIT

G. P.

1 2 3 4 5 8 9 10 11 12 13 14 15 16 17

N

R. 33 W. | R. 32 W.

1 765 000 FEET

(Joins sheet 58)

430 000 FEET

T. 41 N.

(Joins sheet 70)

COUNTY

WASHABAUGH

420 000 FEET

(Joins sheet 80)

1 785 000 FEET

Scale 1:20 000

1 Mile

5 000 Feet

Black Pipe Creek

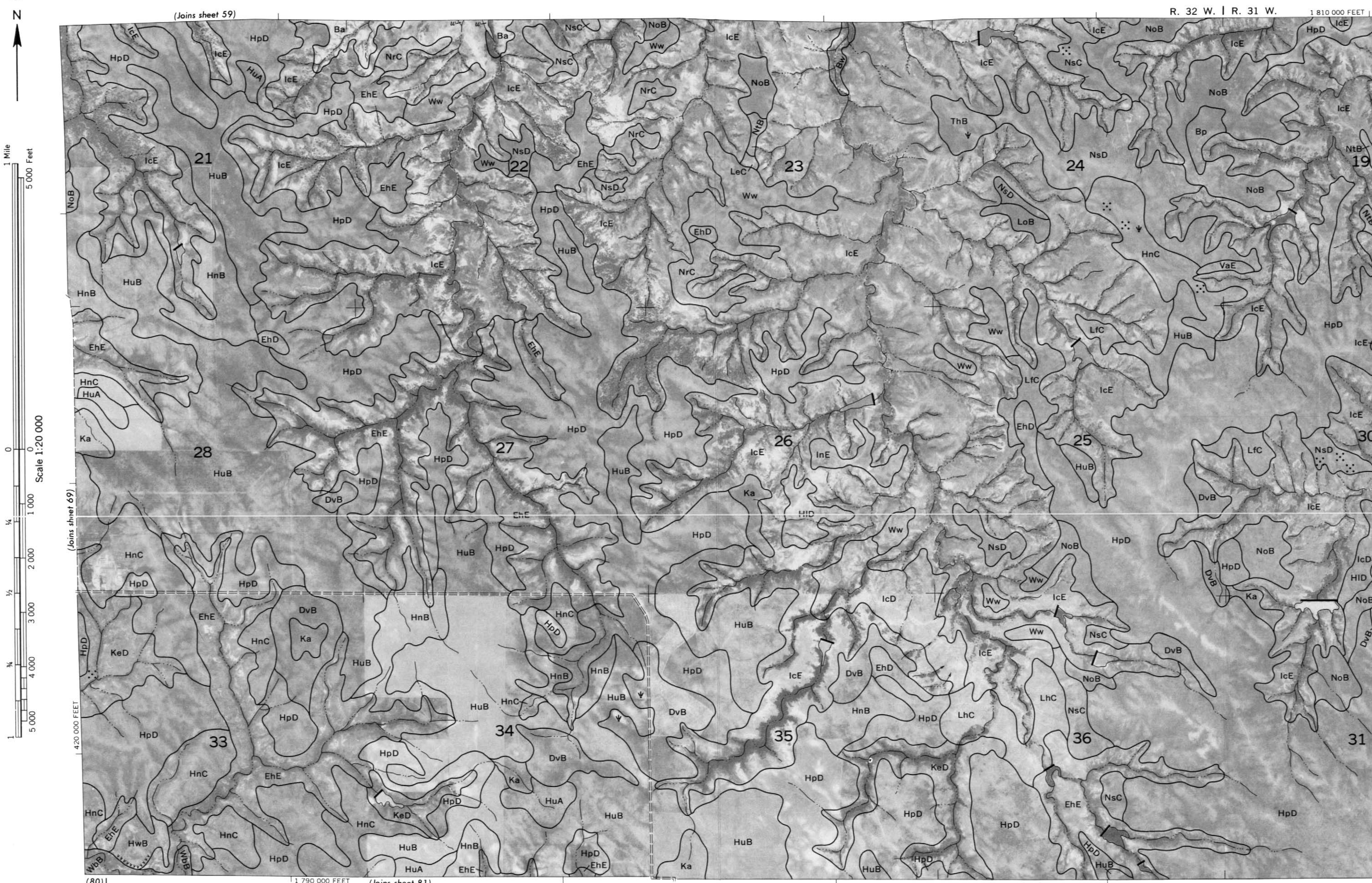
Dry Creek

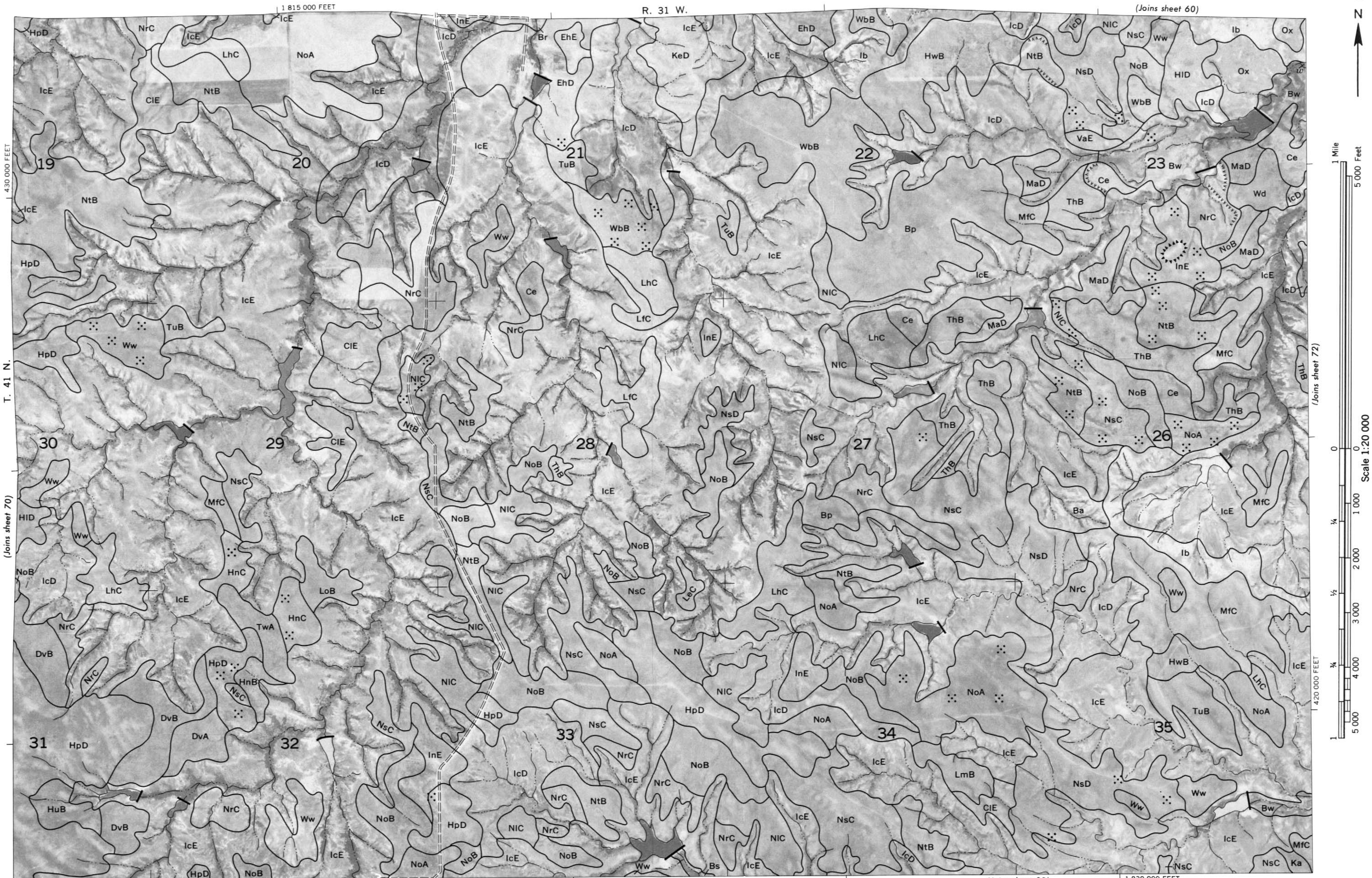
Black Pipe Creek

22 23 24 19 20

27 26 25 30 29

34 35 36 31 32


N
(Joins sheet 59)
R. 32 W. | R. 31 W.
1 810 000 FEET
430 000 FEET
T. 41 N.
(Joins sheet 71)
(Joins sheet 69)
420 000 FEET
(80)
1 790 000 FEET
(Joins sheet 81)
Scale 1:20 000
1 Mile
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1
19
21
22
23
24
25
26
27
28
30
31
33
34
35
36


71
N
1 815 000 FEET
R. 31 W.
(Joins sheet 60)
430 000 FEET
T. 41 N.
(Joins sheet 70)
(Joins sheet 72)
(Joins sheet 82)
420 000 FEET
1 830 000 FEET
19
20
21
22
23
30
29
28
27
26
31
32
33
34
35
1 Mile
5 000 Feet
Scale 1:20 000
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1

R. 31 W. | R. 30 W. (Joins sheet 61)

1 855 000 FEET

T. 41 N.

430 000 FEET

420 000 FEET

(Joins sheet 71)

(Joins sheet 73)

(Joins 82) | 1 835 000 FEET (Joins sheet 83)

Scale 1:20 000

1 Mile 5 000 Feet

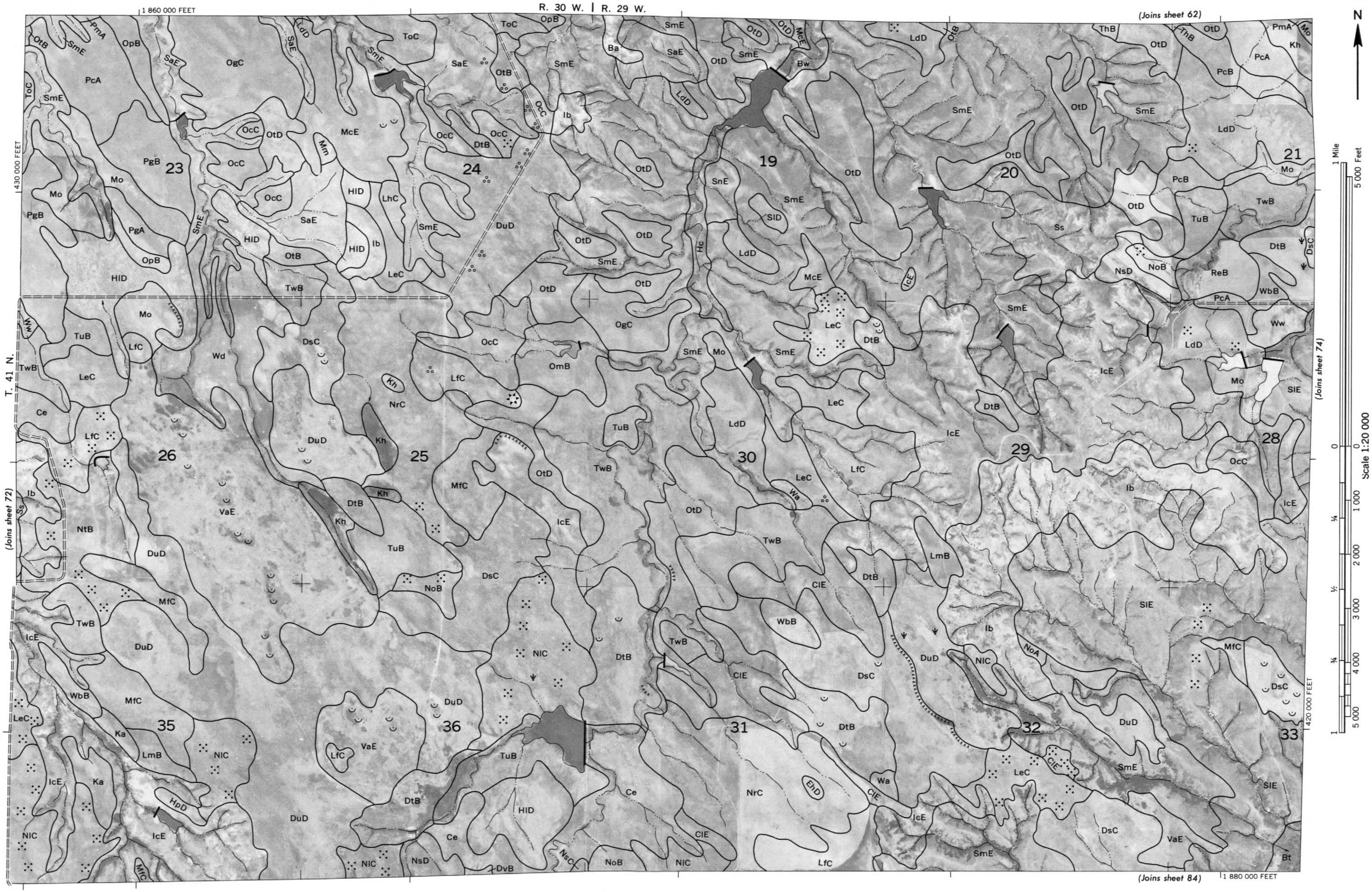
0 0 1/4 1 000 1/2 2 000 3/4 4 000 1 5 000

Creek

Pine

Branch

South


73
N
R. 30 W. | R. 29 W.
1 860 000 FEET
(Joins sheet 62)
430 000 FEET
T. 41 N.
(Joins sheet 72)
(Joins sheet 74)
(Joins sheet 84)
1 880 000 FEET
420 000 FEET
23
24
19
20
21
26
25
30
29
28
35
36
31
32
33
1 Mile
5 000 Feet
Scale 1:20 000
0
¼
½
¾
1
0
1 000
2 000
3 000
4 000
5 000

N

R. 29 W. | R. 28 W.

1 905 000 FEET

1 430 000 FEET

T. 41 N.

(Joins sheet 63)

(Joins sheet 73)

(Joins sheet 75)

(Joins sheet 85)

420 000 FEET

1 885 000 FEET

1 Mile

5 000 Feet

Scale 1:20 000

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

1 5 000

21 22 23 24 19 28 27 26 25 30 33 34 35 36 31

RIVER

WHITE

FORK

Horse Creek

SOUTH

Head Horse Creek

GRAVEL PIT

83

N

1 910 000 FEET

R. 28 W.

(Joins sheet 64)

430 000 FEET

T. 41 N.

(Joins sheet 74)

(Joins sheet 76)

1 925 000 FEET

(Joins sheet 86)

(Joins 87)

1 Mile

5 000 Feet

Scale 1:20 000

420 000 FEET

N

R. 28 W. | R. 27 W.

(Joins sheet 65)

1 950 000 FEET

T. 41 N.

R. 430 000 FEET

(Joins sheet 75)

(Joins sheet 77)

1 930 000 FEET

(Joins sheet 87)

420 000 FEET

1 Mile

5 000 Feet

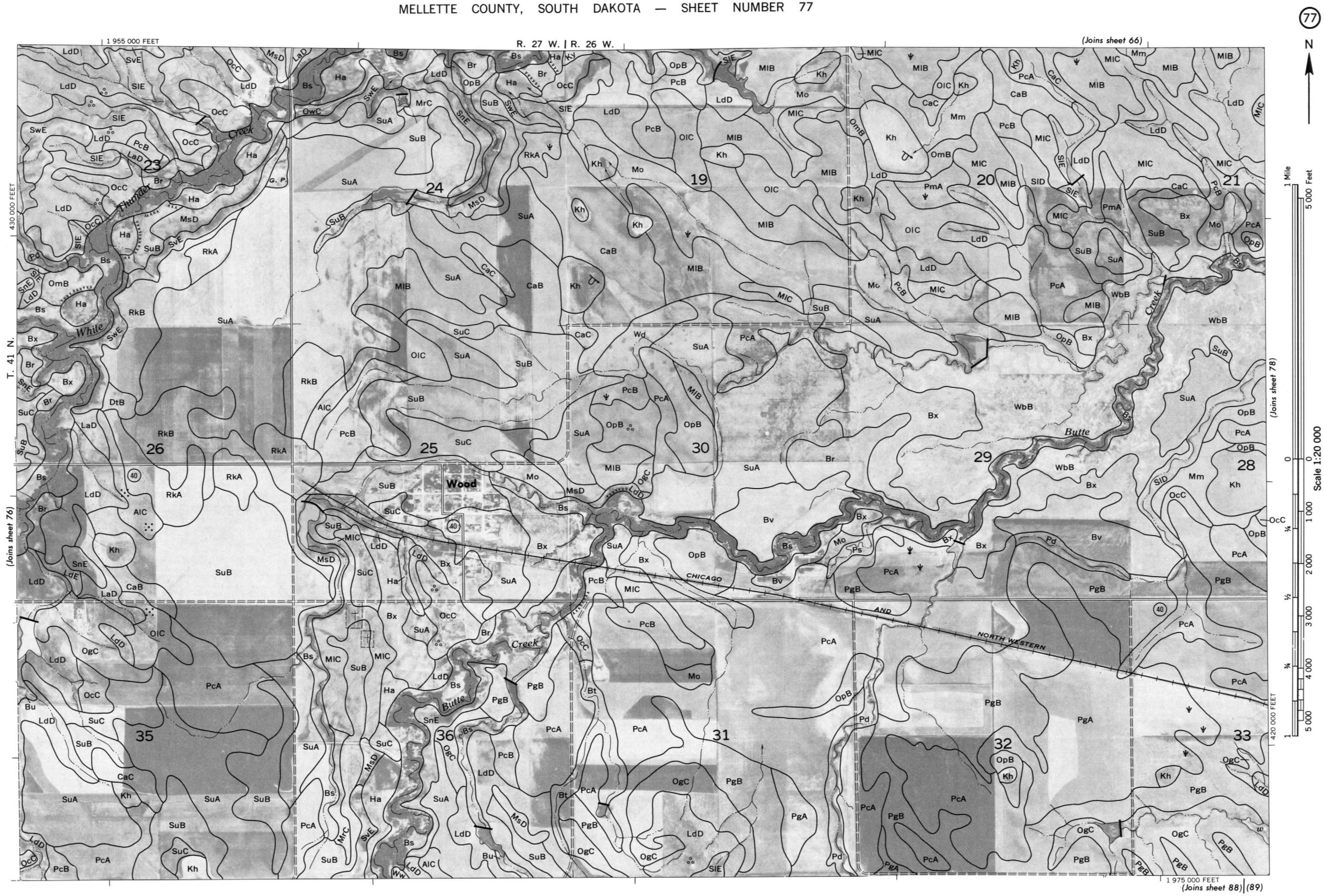
Scale 1:20 000

0 0 ¼ 1 000 ½ 2 000 ¾ 3 000 1 4 000 1¼ 5 000

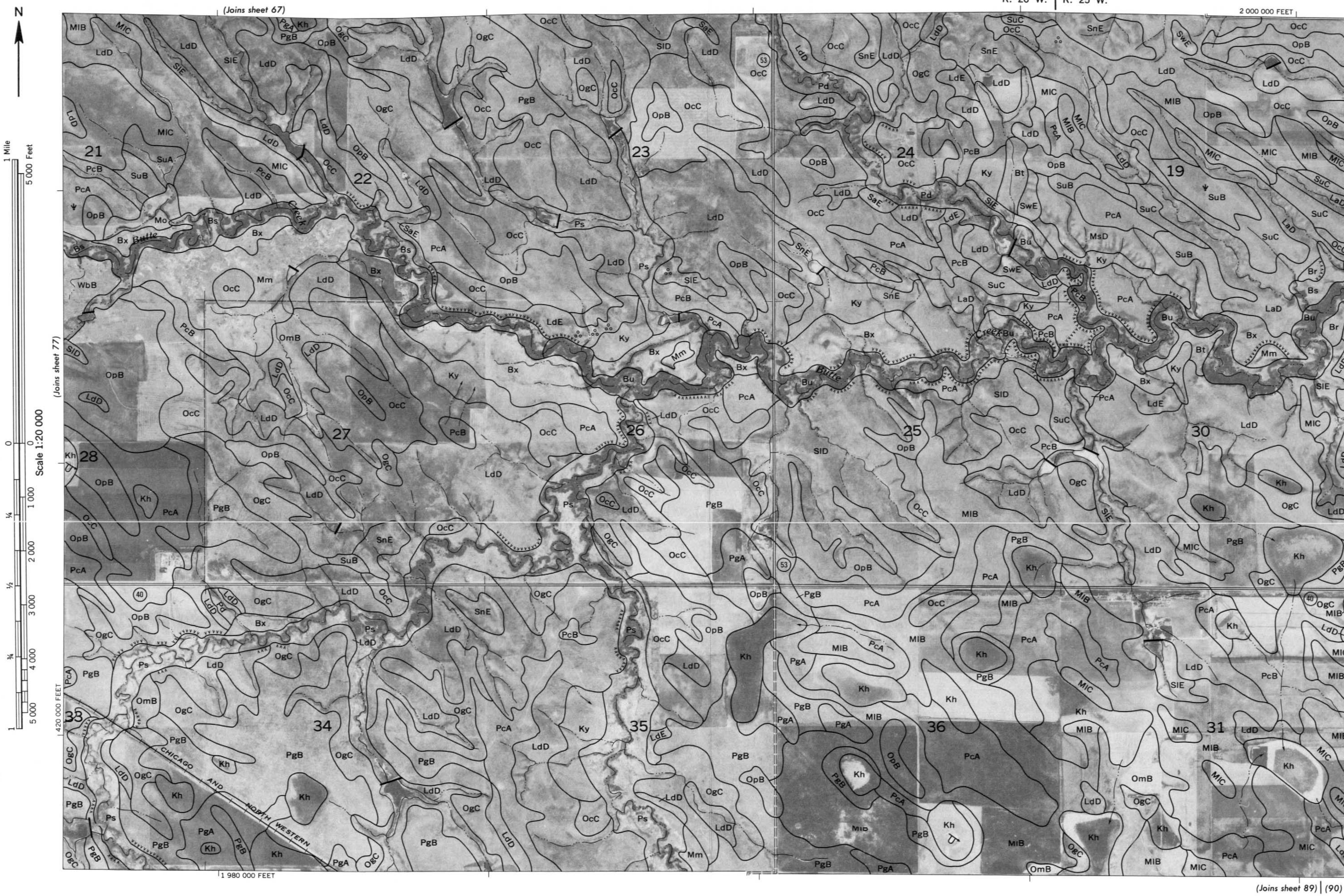
Creek

Thunder

White


77
N
1 955 000 FEET
R. 27 W. | R. 26 W.
(Joins sheet 66)
T. 41 N.
430 000 FEET
(Joins sheet 76)
(Joins sheet 78)
Thunder Creek
White Creek
Butte Creek
Wood
CHICAGO AND NORTH WESTERN
40
G. P.
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36
1 Mile
5 000 Feet
Scale 1:20 000
420 000 FEET
1 975 000 FEET
(Joins sheet 88)
(89)

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 78



2 005 000 FEET

R. 25 W.

(Joins sheet 68)

430 000 FEET

T. 41 N.

(Joins sheet 78)

(Joins sheet D, sheet 35)

420 000 FEET

2 020 000 FEET

(Joins sheet 90)

(Joins inset 102)

N

1 Mile

5 000 Feet

Scale 1:20 000

0 0

1 000 ¼ 2 000 ½ 3 000 ¾ 4 000 1 5 000


(Joins sheet 69)
R. 33 W.
R. 32 W.
1 785 000 FEET
415 000 FEET
T. 40 N.
SEWAGE LAGOON
Norris School
Norris
INDIAN CEMETERY
NORRIS CEMETERY
Dry Creek
Black Pipe Creek
WASHABAUGH COUNTY
1 405 000 FEET
1 765 000 FEET
(Joins sheet 91)
(Joins sheet 81)
1 Mile
5 000 Feet
Scale 1:20 000
1 000
2 000
3 000
4 000
5 000
N

81

N

1 790 000 FEET

R. 32 W.

(Joins sheet 70)

415 000 FEET

T. 40 N.

(Joins sheet 80)

(Joins sheet 82)

405 000 FEET

1 805 000 FEET

(Joins sheet 92)

St Johns Church

Prairie View School

1 Mile

5 000 Feet

Scale 1:20 000

N

R. 32 W. | R. 31 W.

1 830 000 FEET

(Joins sheet 71) | (Joins 72)

415 000 FEET

T. 40 N.

405 000 FEET

1 Mile

5 000 Feet

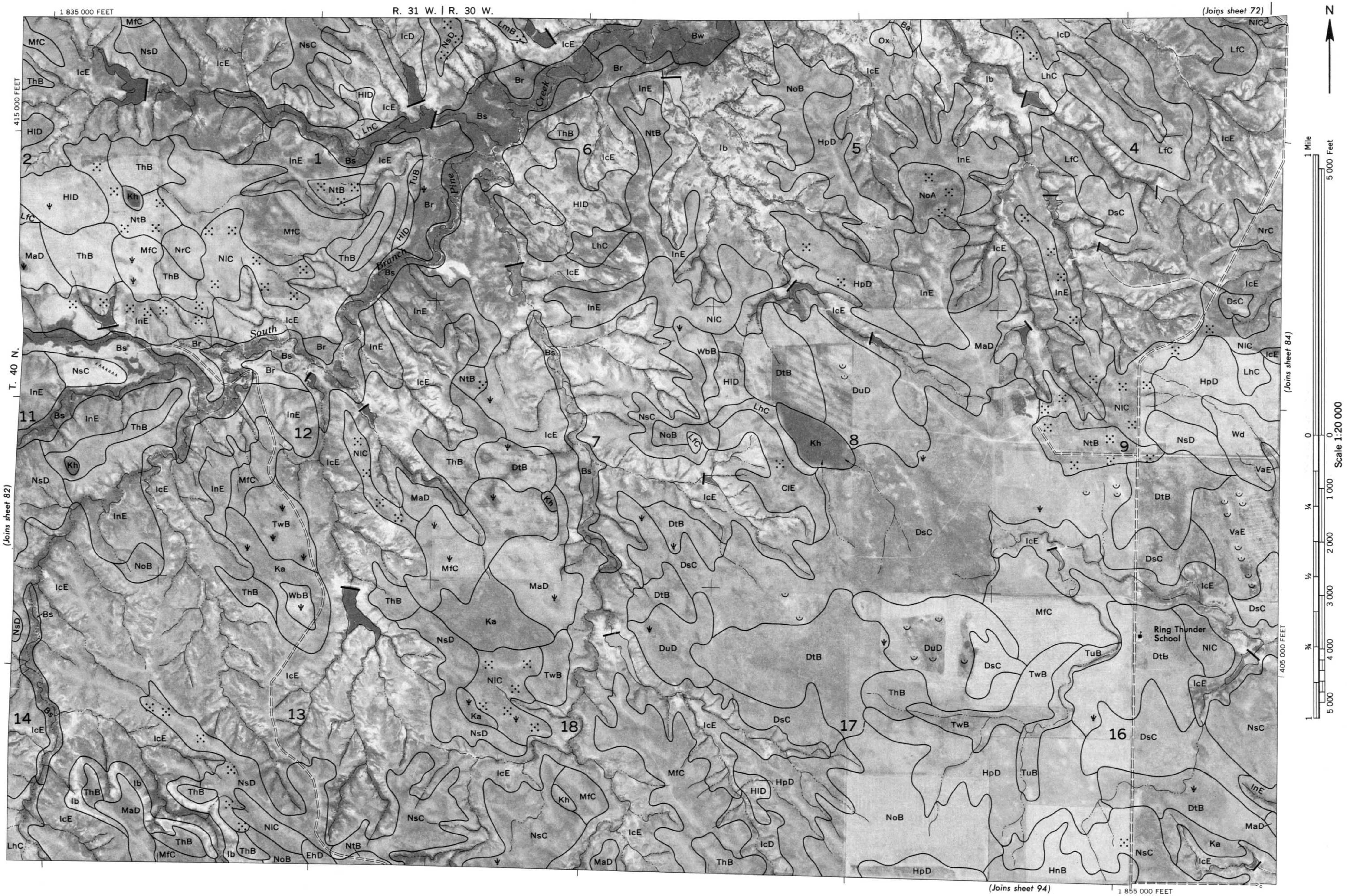
Scale 1:20 000

(Joins sheet 81)

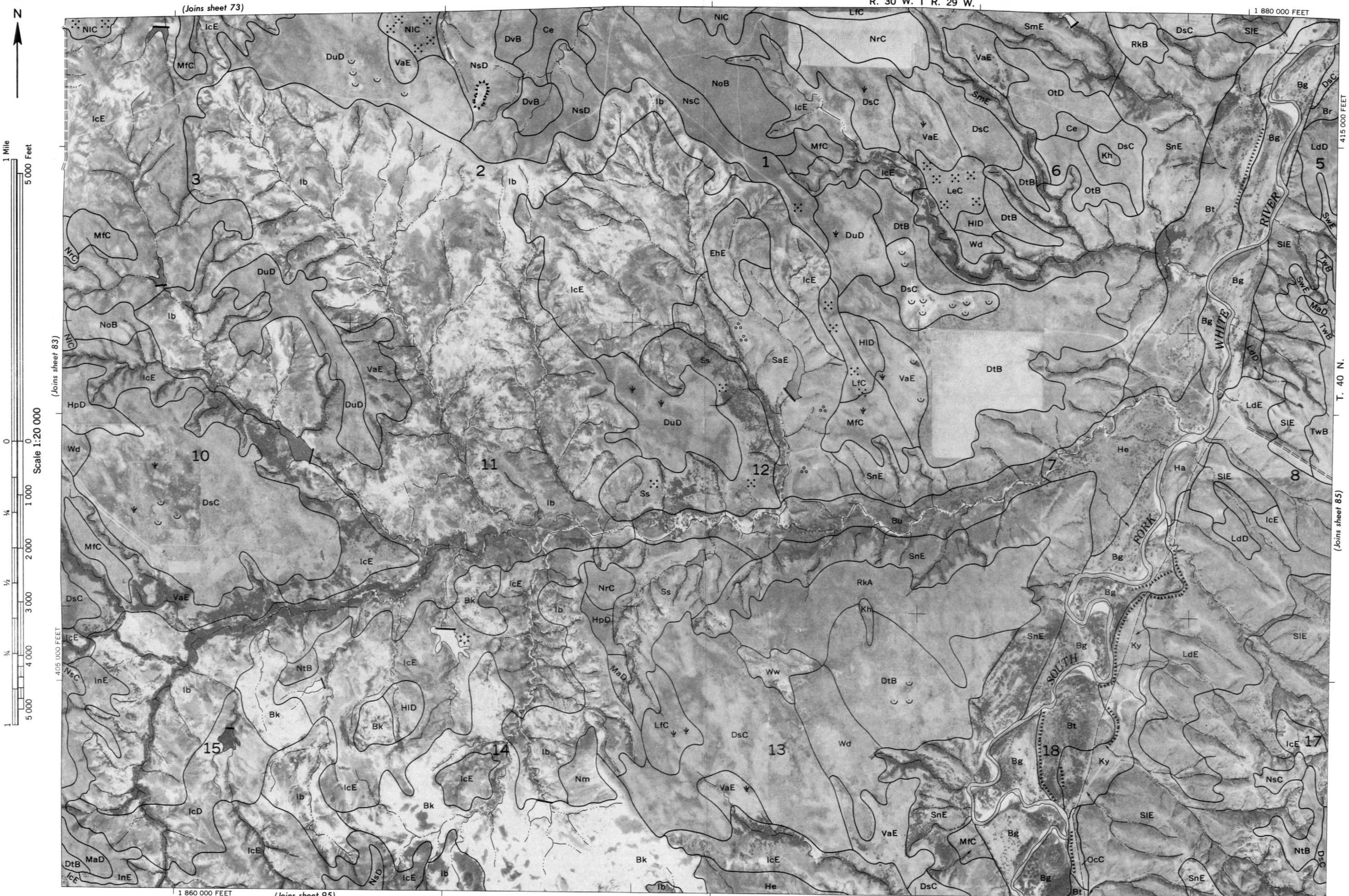
1 810 000 FEET

(Joins sheet 93)

(Joins sheet 83)


1 835 000 FEET
R. 31 W. | R. 30 W.
(Joins sheet 72)
415 000 FEET
T. 40 N.
(Joins sheet 82)
(Joins sheet 84)
405 000 FEET
(Joins sheet 94)
1 855 000 FEET
Pine Creek
South Branch
Ring Thunder School
N
1 Mile
5 000 Feet
Scale 1:20 000

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 84



MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 85

85

N

1 885 000 FEET

R. 29 W.

(Joins sheet 74)

415 000 FEET

T. 40 N.

(Joins sheet 84)

(Joins sheet 96)

1 905 000 FEET

405 000 FEET

Horse Head Creek

Horse Creek

Scale 1:20 000

1 Mile

5 000 Feet

(Joins sheet 86)

N

R. 28 W.

1 925 000 FEET

415 000 FEET

T. 40 N.

(Joins sheet 75)

(Joins sheet 87)

(Joins sheet 85)

405 000 FEET

1 910 000 FEET

(Joins sheet 97)

1 Mile

5 000 Feet

Scale 1:20 000

0 0 ¼ 1 000 ½ 2 000 ¾ 3 000 1 4 000 5 000

Horse Head Creek

6 5 4 3 2 7 8 9 10 11 18 17 16 15 14

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 87

(87)

N

(Joins 75)

1 930 000 FEET

(Joins sheet 76)

R. 28 W. | R. 27 W.

415 000 FEET

T. 40 N.

(Joins sheet 86)

(Joins sheet 88)

(Joins sheet 98)

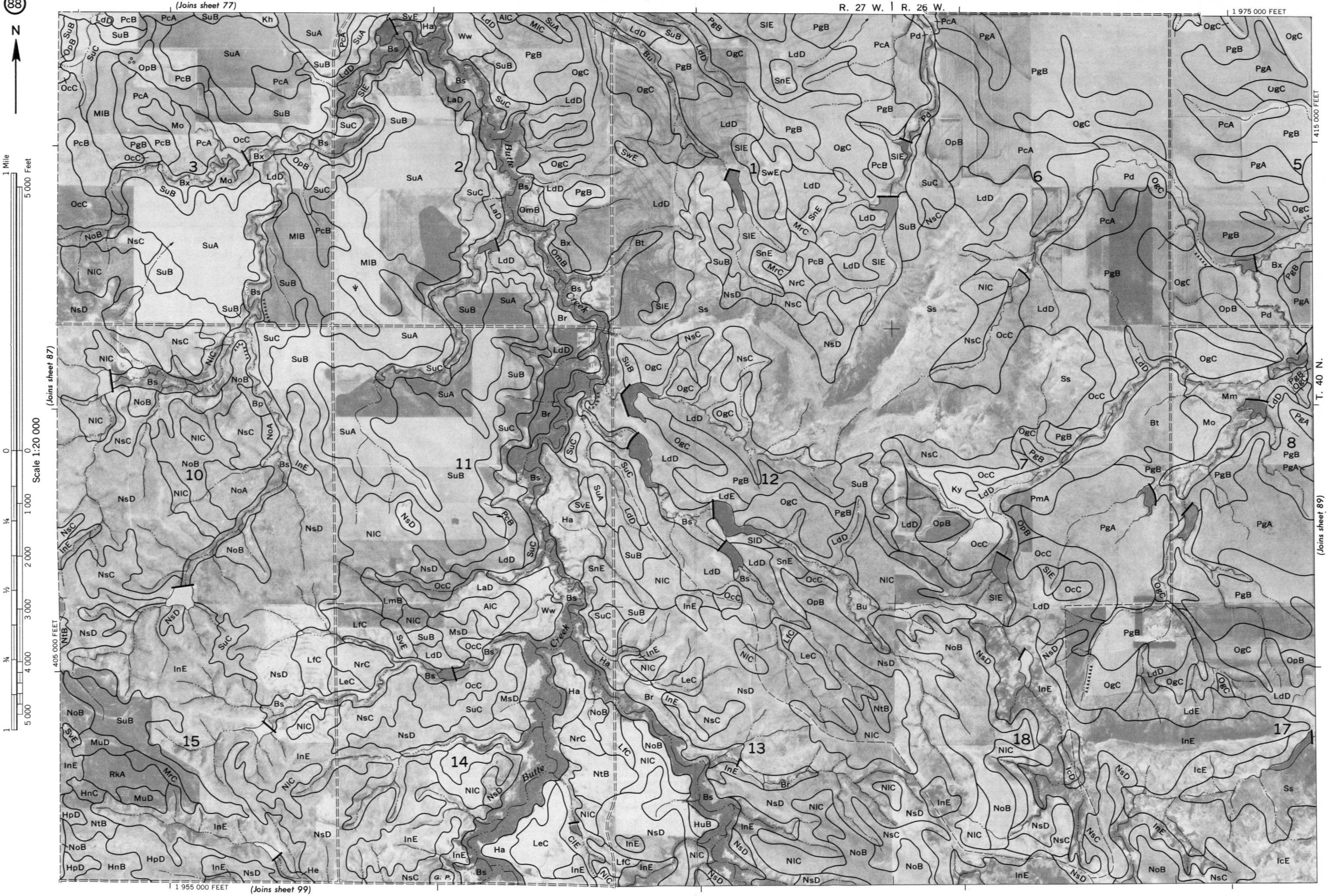
1 950 000 FEET

1 Mile

5 000 Feet

Scale 1:20 000

405 000 FEET


(Joins sheet 77)
R. 27 W.
R. 26 W.
1 975 000 FEET
415 000 FEET
T. 40 N.
(Joins sheet 89)
(Joins sheet 87)
405 000 FEET
1 955 000 FEET
(Joins sheet 99)
N
1 Mile
5 000 Feet
Scale 1:20 000
Butte Creek
Creek
Butte
1
2
3
5
6
7
8
10
11
12
13
14
15
17
18

(77) (Joins sheet 78)

1 980 000 FEET

R. 26 W.

89

N

415 000 FEET

T. 40 N.

CHICAGO AND NORTH WESTERN

RATTLESNAKE BUTTE

(Joins sheet 88)

(Joins sheet 90)

(Joins sheet 100)

2 000 000 FEET

405 000 FEET

1 Mile

5 000 Feet

Scale 1:20 000

1 000 2 000 3 000 4 000 5 000

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 90

90

N

(78) | (Joins sheet 79)

SnE

R. 25 W.

LaD

2 020 000 FEET

415 000 FEET

T. 40 N.

(Joins inset, sheet 102)

405 000 FEET

(Joins sheet 89)

(Joins sheet 101)

2 005 000 FEET

1 Mile

5 000 Feet

Scale 1:20 000

Mosher

CHICAGO AND NORTH WESTERN

Oak Creek

Hoarsman School

G. P.

N

1 765 000 FEET

400 000 FEET

R. 33 W.

R. 32 W.

(Joins sheet 80)

(Joins sheet 92)

WASHABAUGH COUNTY

T. 40 N.

21 22 23 24 19
28 27 26 25 30
33 34 35 36 31

DvA EhD HnB HwB Ka DvB WbB Ww HuB NtB HpD Bg RkA Wa HnC Ww DvA Kh TwB Wd MfC KeD EhE MuD ThB AlC Creek Pipe Black

TODD COUNTY

1 785 000 FEET

390 000 FEET

1 Mile 5 000 Feet

Scale 1:20 000

0 5 000 1 000 2 000 3 000 4 000

N

(Joins sheet 81)

R. 32 W.

1 805 000 FEET

400 000 FEET

T. 40 N.

(Joins sheet 91)

390 000 FEET

1 790 000 FEET

(Joins sheet 93)

1 Mile

5 000 Feet

Scale 1:20 000

20 21 22 23 24

29 28 27 26 25

32 33 34 35 36

Gray Eagle Creek

Swimmer Creek

63

TODD COUNTY

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 93

93

N

1 810 000 FEET

R. 32 W. | R. 31 W.

(Joins sheet 82)

400 000 FEET

T. 40 N.

(Joins sheet 94)

(Joins sheet 92)

390 000 FEET

1 830 000 FEET

TODD COUNTY

1 Mile 5 000 Feet

Scale 1:20 000

0 0 ¼ 1 000 ½ 2 000 ¾ 4 000 1 5 000

N

R. 31 W. | R. 30 W.

1 855 000 FEET

400 000 FEET

(Joins sheet 83)

(Joins sheet 93)

(Joins sheet 95)

T. 40 N.

1 Mile

5 000 Feet

Scale 1:20 000

390 000 FEET

1 835 000 FEET

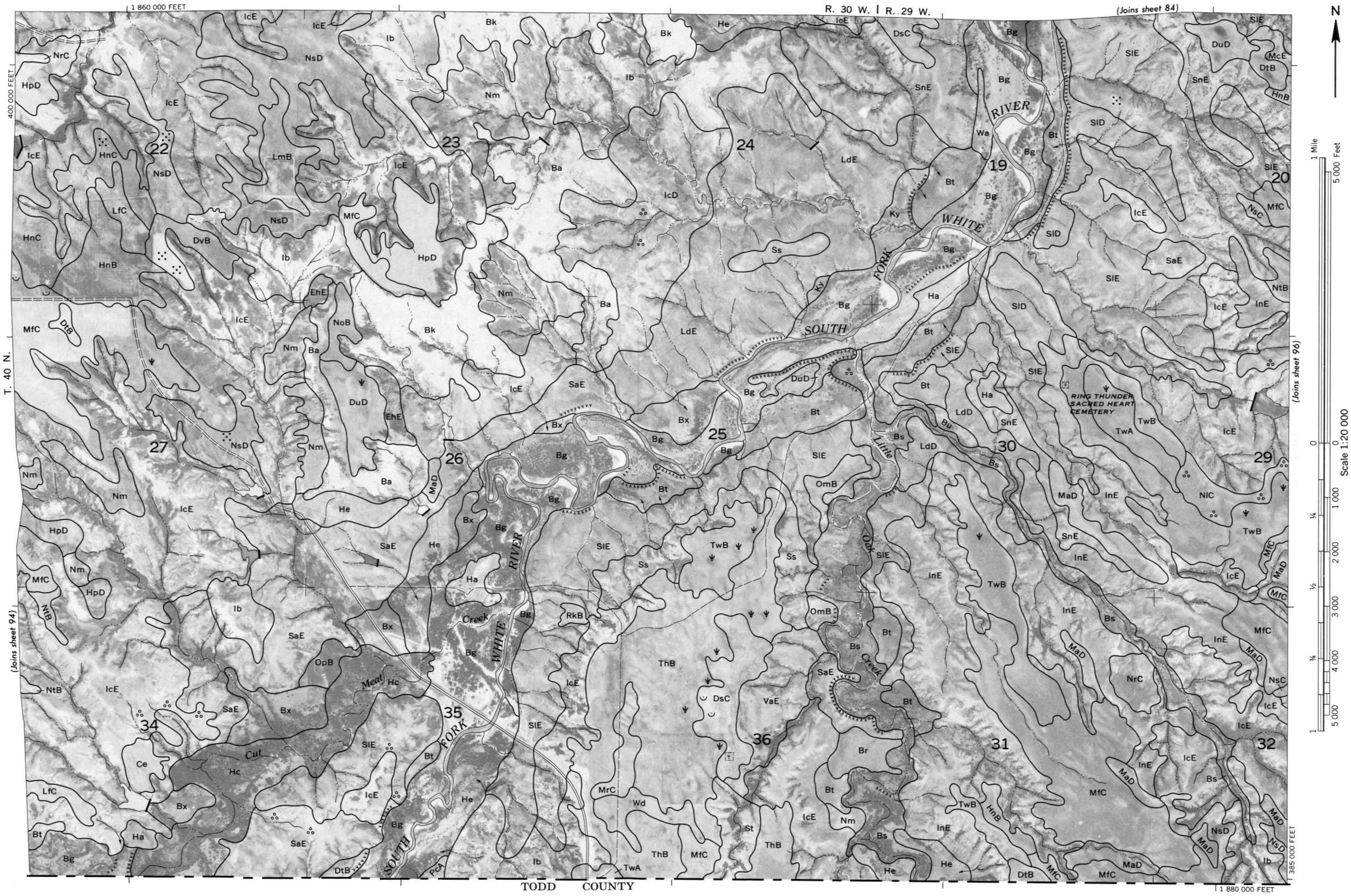
TODD COUNTY

23 24 19 20 21 26 25 30 29 28 35 36 31 32 33

water

Meat Creek

Cut


95
N
1 860 000 FEET
400 000 FEET
R. 30 W. | R. 29 W.
(Joins sheet 84)
(Joins sheet 96)
(Joins sheet 94)
T. 40 N.
385 000 FEET
1 880 000 FEET
TODD COUNTY
SOUTH FORK WHITE RIVER
Little Oak Creek
Meat Cut
Creek
RING THUNDER SACRED HEART CEMETERY
19
20
22
23
24
25
26
27
29
30
31
32
34
35
36
1 Mile
5 000 Feet
Scale 1:20 000
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1

N

(Joins sheet 85)

R. 29 W.

1 905 000 FEET

400 000 FEET

T. 40 N.

(Joins sheet 95)

(Joins sheet 97)

1 Mile

5 000 Feet

Scale 1:20 000

20 21 22 23 24

29 28 27 26 25

32 33 34 35 36

Horse Creek

385 000 FEET

1 885 000 FEET

TODD COUNTY

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 97

97

N

(Joins sheet 86)

1 910 000 FEET

R. 28 W.

400 000 FEET

T. 40 N.

(Joins sheet 96)

(Joins sheet 98)

390 000 FEET

1 925 000 FEET

TODD COUNTY

1 Mile

5 000 Feet

Scale 1:20 000

98

N

(Joins sheet 87)

R. 28 W. | R. 27 W.

1 950 000 FEET

1 400 000 FEET

T. 40 N.

(Joins sheet 97)

(Joins sheet 99)

1 Mile

5 000 Feet

Scale 1:20 000

1 930 000 FEET

390 000 FEET

TODD COUNTY

Thunder Creek

White

GRAVEL PIT

QUARRY PIT

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 99

99

N

1 955 000 FEET

400 000 FEET

R. 27 W. | R. 26 W.

(Joins sheet 88)

(Joins sheet 100)

(Joins sheet 98)

T. 40 N.

G. P.

Creek

Butte Creek

1 Mile

5 000 Fee

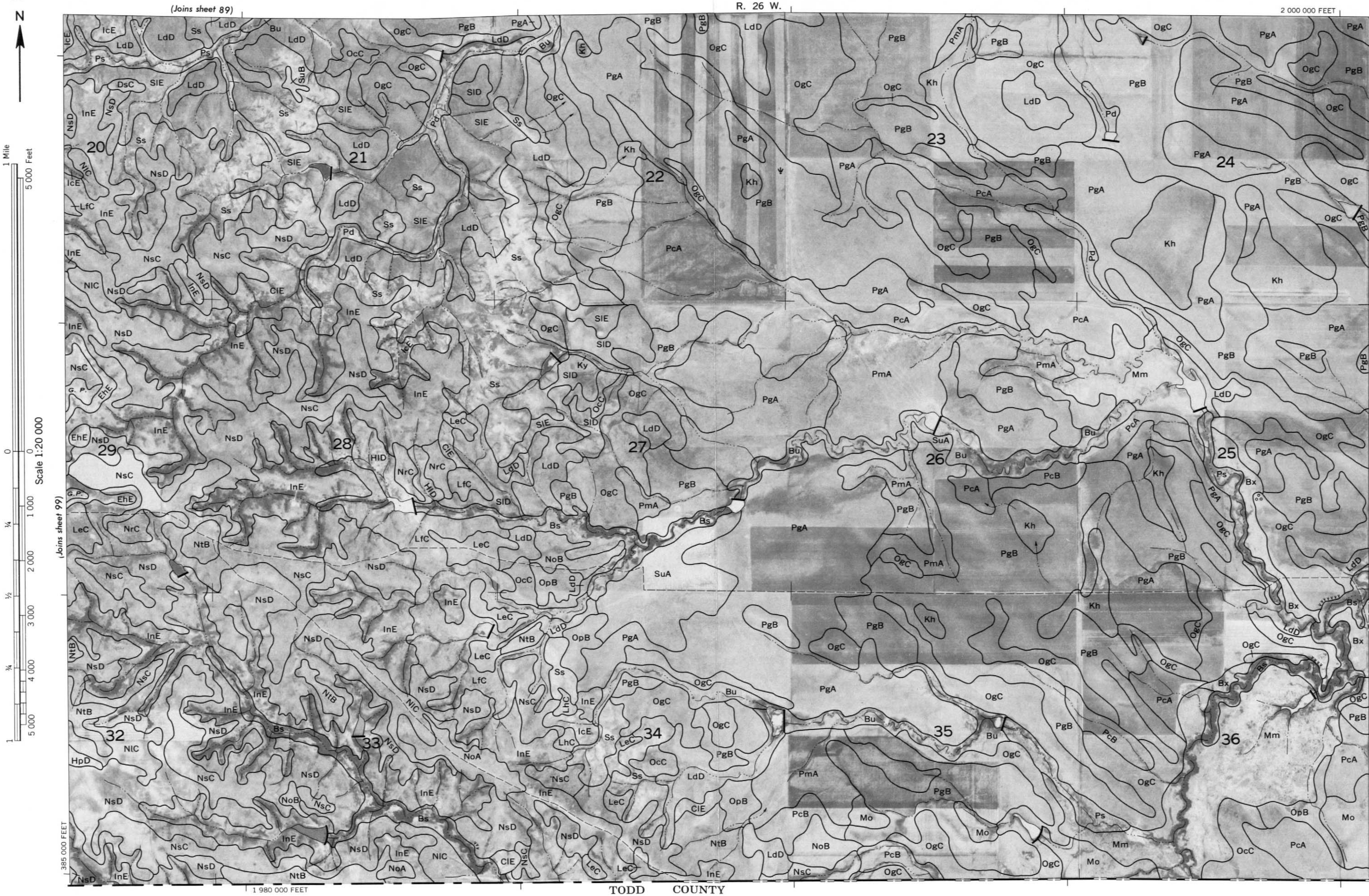
Scale 1:20 000

1 975 000 FEET

385 000 FEET

TODD COUNTY

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 100



2 005 000 FEET

R. 25 W.

(Joins sheet 90)

400 000 FEET

T. 40 N.

(Joins sheet 100)

(Joins sheet 102)

TODD COUNTY

2 020 000 FEET

385 000 FEET

N

1 Mile

5 000 Feet

Scale 1:20 000

1 5 000 0 0 5 000 1 000 2 000 3 000 4 000

MELLETTE COUNTY, SOUTH DAKOTA — SHEET NUMBER 102